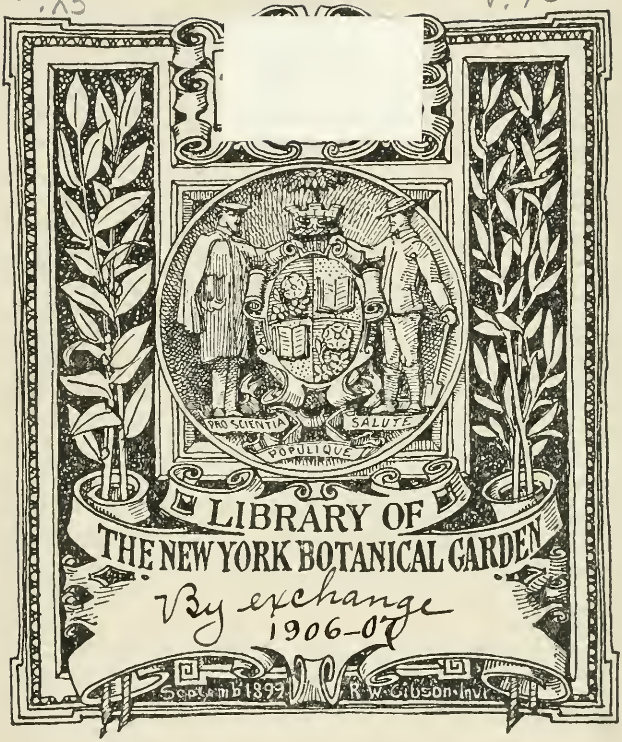
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NOTE.—The publications of the United States Department of Agriculture, except those of the Weather Bureau, may be purchased from the Superintendent of Documents, Washington, D. C. For the publications of the Weather Bureau, requests and remittances should be directed to the Chief of the Bureau. The price of the Record is $1 per volume, or 10 cents per number. The prices of other technical publications are given in the list above. The publications of the State experiment stations are distributed from the stations and not from the Department.

ILLUSTRATION.

EXPERIMENT STATION RECORD.

VOL. XVIII. SEPTEMBER, 1906. No. 1.

In all lines of investigation the individual is the all-important and determining factor. Buildings, equipment, the scientific atmosphere, and the inspiration of the field all contribute to make the conditions favorable and to stimulate activity; but without the genius and originality of the man himself the progress along original lines will be slow and uncertain. Upon him will depend in very large measure the character and the success of the investigation.

In agriculture this is especially the case. Agricultural research calls for very special qualifications in the way of native ability and scientific acumen. It requires as high order of training and experience as any line of research in either pure or applied science, and in addition it demands a general knowledge of practical methods and conditions in order that the investigation may be directed intelligently. It represents the culmination of efforts for the advancement of agriculture upon an enlightened and scientific basis, and as such it should have the very best material available, surrounded by conditions which will be conducive to the best results. More depends upon it for the progress of the human race than upon research in any other line of industry.

The problems in agriculture are complex, requiring a deep insight and the ability to separate them into their various phases. The investigator should have a sufficient grasp of the subject in both its practical and its scientific relations to be able to analyze it and determine the point of attack. This implies thorough familiarity with the methods of research, the ability to concentrate upon some phase and to make progress on the basis of definite knowledge. For scientific study the projects must not be too broad or include too many factors of possible influence. They must be simplified so as to bring them down to a working basis, and gradually as one point after another is cleared up, they can be broadened and extended.

The difficulty which some men have in outlining a project definitely, so that it may be considered by itself as a definite phase instead of as a broad problem, is in part due to insufficient training for research. Too few of our station men have had the advanced train-

ing which this requires. It is not acquired in the regular college course. It comes with special study under a trained mind, in the course of which something of the spirit of investigation is imbibed, the meaning of an investigation is learned, and familiarity is gained with the methods of procedure. Unless a man has had this or its equivalent, it is too much to expect that he can fully appreciate the real differences between research which gives definite knowledge, and more superficial experiments which give results only half understood, or that he can differentiate his subject and outline a scientific method of procedure.

Station men divide themselves into three general classes, all useful in the advancement of agriculture, but with special qualifications which should be recognized in organizing the work. There is the man in especially close touch and sympathy with the farmer, who is impressed with the need of disseminating information upon matters already known, and whose greatest interest and success lies along the line of demonstration experiments and extension work—a promoter as it were, who by the force of his enthusiasm and his ability to present matters in a convincing way has great influence in introducing improved methods and in spreading the work of the station. This is essentially extension work. It depends upon the work of others, and lacks originality except in interpretation and application. Such men are not suited temperamentally to the work of investigation, but they may be able to make better use of the results than the investigator himself.

Another class of men conduct trials and experiments upon a great variety of practical questions in farm management, using rather simple, conventional methods, and often carrying the work out upon a commercial scale. A considerable amount of scientific data may be collected in their work, but this is reported in a somewhat incidental manner, and is not digested and marshalled in such a way as to contribute to a scientific understanding of the results observed or the principles involved. The real object is to show the most economical method of fertilizing for a given crop, the comparative value of this and that feeding stuff, the yield returned under different methods of culture, and the like.

A third group of men always have in mind, even in what are apparently simple experiments, a recognition of the principles which are operative and which serve to explain the results. They so plan their work as to not only give the farmer a practical answer, but to answer the questions of science as well. They are not satisfied with the empirical result. The spirit of the investigator demands to know why, and they will not be satisfied until they have worked out the fundamental reason.

The last class unfortunately makes up the smaller number. The gap between them and the second class is often a narrow one, and shows itself chiefly in an attitude of mind. Their work often does not appeal as strongly to the popular mind, and arouses little interest until some brilliant result is secured. It is not spectacular in character, and there is greater difficulty in securing appropriations for it. It was largely for this reason that Congress was asked to provide the means for extending it through a permanent appropriation.

The scarcity of men suited to the advanced work contemplated by the Adams Act is the principal cause of difficulty experienced in preparing for operations under that act. It represents a certain unreadiness in some instances.

This scarcity is to a large degree a result of the ideals and tendencies which have dominated station work in the past. The practical phase—the immediately practical phase—has been constantly in the foreground. The earlier years of the stations' existence were given to winning the farmer's confidence and support by doing work which would appeal directly to his practical sense, and since then we have been busy trying to answer, usually in the quickest way, the questions he has showered upon us. There has been an increasing demand for such work, and there has grown up a too prevalent idea that, as the stations belong to the farmers, their duty is to serve the farmer in his own way. In our desire to recognize him we have gone to the extreme in some respects, and it has affected our progress as scientific institutions. It has done more; it has affected our standards of ourselves and of our own requirements. It has given false ideals to young men preparing to enter the work, and insufficient encouragement to those who have striven to give their work a deeper trend. Too often the measure of a man's success has seemed to be his ability to get at the farmers, and to do some comparatively simple work which attracted popular attention. The standard for station workers has been too low. This has already had its effect, which is now being keenly felt in a lack of the true spirit of investigation and a scarcity of men suited to undertake it.

There is no question as to the ultimate aim of the stations, or the desirability of doing work which will be of assistance to the farmer. The station is for the benefit of the farmers as a body—for agriculture; but it is a mistake to encourage the impression that the station is a question box, and to make the immediately practical experiment the only goal of our ambition. There is little danger at our American stations that the practical needs of the farmer will not be kept prominently in mind; but with the progress of our work year by year there is great need of broader and deeper study of the problems we are passing upon, to reduce the empirical results to a more scientific foundation and furnish a safer basis for generalizations.

The planning and inauguration of work under the Adams Act will require careful gauging of the abilities of different members of the station staff, in order to select those best suited to undertake investigations. It must recognize the advanced character of the work to be undertaken and the special qualifications of the individuals composing the staff.

At many of the stations there is a quite general demand from the different departments for a share of the new fund to supplement their resources, and the easiest method is naturally to divide it between the different departments of the station without a very critical consideration of the proposed work. This will not meet the requirements, and will surely not yield the best results. It will include work which does not belong under that fund, and it will usually provide too many projects, reducing the means available for each so that it will be impossible to do the thorough work which is contemplated. The projects need to be very carefully sifted, and those selected which commend themselves especially by reason of their character, their ultimate importance, and the facilities of the station.

In every station there are some men and some departments better fitted to this higher work than others. In every case a process of selection or elimination must be followed, and in some cases men must be secured from the outside to plan and conduct the new lines of investigation. At best only a few men in each station should be selected at the outset.

Not only does the new work raise the grade of requirements in the personnel, but it calls for a differentiation in the station work as a whole—for greater concentration upon investigation as distinguished from other duties. Obviously a man engaged in such work should not be hindered and burdened by elementary teaching or farmers' institute work or answering miscellaneous correspondence or supervising control or police work. The college and station work should be so organized as to free him from such interruptions and distractions, except on special occasions. Other men can attend to these various duties, but the man with the genius for investigation is too rare to be sacrificed to the duties more easily provided for.

Already there has been considerable demand for new men with good scientific education and capable of advanced work—usually for men who have developed as experts in special lines. This will result in a shifting of men from one institution to another, and the keen competition for the men of established reputation will doubtless result in many of the institutions with smaller revenues losing their most valuable men to the larger and more favored ones. This shifting is a very serious matter, often resulting in much waste of time and funds in incomplete investigations. Time is required for becoming familiar with new conditions and for establishing the work in a

new locality. On the other hand, much time is lost to the station in finding and training another man, and the efficiency of the station in that line is temporarily diminished. There is no saving in exchanging a man of known ability and usefulness for one a few hundred dollars cheaper who is an uncertain quantity and must learn the conditions and adjust himself. On the contrary, there is a period of unproductiveness and uncertainty which is expensive to the station and an added strain on the administration.

These changes in personnel might often be avoided by a fuller recognition of the relative value of the man to the station, and a breaking away from tradition or uniformity in the matter of salary. This should be appreciated by those responsible for the stations' welfare. Any station which has a man with a real genius for investigation in the lines it proposes to pursue should make every effort to retain him, even at the sacrifice of precedent. Given a similar line of problems, an investigator of recognized ability is usually as valuable to the station where he is as to another. The Adams fund has tended toward an equalization of the stations in the matter of investigation. The burden of such work rests upon all alike. Each station now has a special research fund of $7,000 this year, which will go on increasing for the next four years, when it will represent an endowment of $300,000 at 5 per cent. This is a very creditable research fund for any institution, and should enable the payment of salaries which will insure the best men the field affords.

At a considerable number of institutions the scale of salaries is too low to expect the most competent men to remain. The lesson this false economy has taught should have left its impression long ago. Cheap men are always expensive if of indifferent ability, especially in the advanced work of investigation, and if their work is stamped with high ability they are soon called to other positions. Better far to pay a good salary which will keep men satisfied and assure a certain degree of permanency than to lower the grade of efficiency by frequent changes or employing men of second-rate ability.

The station work should not be held down by a low salary standard in the college or university, as is sometimes the case at present. This is an unfortunate policy and fails to recognize three things—the relative scarcity of men of high attainments in agricultural science, the expert character of the service required, and the longer period of the working year in the station than in the instruction departments. Good business judgment must recognize that the supply of men who have specialized in agricultural science and won distinction as investigators is considerably short of the demand. In other walks of life a man's earning capacity is gauged by his ability and the supply of equally able men. There is no reason why this should not hold in

the station work, especially in the advanced work where the highest order of ability is required. Too great conservatism in the matter of salary will surely prevent the expectations of the Adams Act from being fully realized, by keeping down the grade of men who enter and continue in this work, and by causing the better ones to be drawn away to stations which bid higher.

More young men should be encouraged to enter experiment station work and to take advanced courses which will give them a thorough grounding and make them strong and resourceful investigators. A large number of such men are needed in nearly every department of agricultural work to-day. Surely there should be encouragement for men with a taste for research to prepare themselves for it along agricultural lines. A career is open to them which is attractive from the fullness of the field and the opportunity for great public usefulness. The pecuniary rewards are not such as may be reached in commercial lines, although there the higher salaries are actually reached by only the few. But such work is inviting to men with a taste for it, aside from the mere matter of salary, and in no line of research is a more inspiring field open. The high grade of the service should be fully recognized in both the dignity of the position and the salary. Competent recruits are needed now more than ever before in the history of our stations. They are essential to the development of their work and to meeting the requirements and expectations of the Adams Act.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

On the free acids in mineral and bone superphosphates, A. QUARTAROLI and G. MASONI (*Staz. Sper. Agr. Ital., 38 (1905), No. 5–6, pp. 492–502; abs. in Chem. Centbl., 1905, II, No. 13, pp. 984, 985*).—To determine free acids the authors shake up 25 gm. of material with 250 cc. of water for a few minutes, filter quickly through a folded filter, and titrate 50 cc. of the filtrate diluted to 300 cc. with one-half normal sodium hydroxid and methyl orange. Of 100 mineral superphosphates thus examined the majority contained from 5.29 to 10.98 per cent of free acids reckoned as phosphoric acid, a few contained as low as 2.6 per cent. The bone superphosphates seldom contained over 2.5 per cent of free acids. The presence of larger amounts, 5 to 6 per cent, indicated adulteration with mineral superphosphate. To further aid in the detection of adulteration the authors determined the constants for inversion of saccharose by the two superphosphates, by phosphoric acid, and by sulphuric acid, by treating 1 gm. of pure saccharose for 6 to 12 hours at 25° C. with 30 cc. of thirtieth-normal solution of these substances and determining the inverted sugar by the Fehling method. These constants, with the results of the titration for free acid and of a physical examination, are thought to furnish reliable means of detection of adulteration of bone superphosphate by mineral superphosphate.

Free acid in superphosphate, L. SCHUCHT (*Ztschr. Angew. Chem., 18 (1905), pp. 1020–1023; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 515, II, p. 610*).—Five gm. of the superphosphate is extracted 10 times with acetone, using in all about 75 cc. of the solvent. The turbid solution obtained is cleared up with 200 cc. of water, a little sodium oxalate and sodium chlorid are added, the solution filtered if necessary, and the free acid is titrated with half-normal alkali, using methyl orange as indicator.

The oxidation of nitrous acid by means of hydrogen peroxid; determination of nitrates in presence of nitrites, M. BUSCH (*Ber. Deut. Chem. Gesell., 39 (1906), No. 6, pp. 1401–1403; abs. in Chem. Centbl., 1906, I, No. 21, p. 1675*).—The author found in experiments with nitro-cellulose that the use of a 3 per cent neutral solution of hydrogen peroxid is a convenient means of quantitatively oxidizing nitrous acid to nitric acid. In a solution containing both nitrous and nitric acids, nitrous acid is first determined in one portion by titration with permanganate, then in another portion of the solution the nitrous acid is oxidized with hydrogen peroxid to nitric acid and determined by means of nitron (E. S. R., 16, p. 945).

Examination of water, W. P. MASON (*New York: John Wiley & Son, 1906, 3. ed., rev., pp. 155, pls. 3, figs. 11*).

Contribution to the determination of nitric acid in water, P. DRAWE (*Chem. Ztg., 30 (1906), No. 43, pp. 530, 531*).—A modification of Frerichs' method (E. S. R., 14, p. 940) is described and recommended.

Modern methods of testing milk and milk products, L. L. VAN SLYKE (*New York: Orange Judd Co.; London: K. Paul, Trench, Trübner & Co., Ltd.,*

1906, pp. XII+214, pl. 1, figs. 56).—This book has been prepared for the use of dairy students, butter makers, cheese makers, milk inspectors, etc., rather than for the chemist, and the methods described are such as do not necessarily require previous chemical training for their successful operation. The Babcock test is very fully considered. Chapters dealing with methods of commercial testing and scoring of butter, cheese, milk, and cream are included. The final chapter gives rules for the various arithmetical calculations frequently necessary in testing milk and milk products, with illustrative examples.

On the oxidation index of milk, E. Comanducci (*Abs. in Chem. Ztg., 30 (1906), No. 41, p. 504*).—In determining the oxidation index of milk, which is believed to furnish important information concerning the quality of milk, 10 cc. of milk is diluted with water to 1 liter, 20 cc. of dilute sulphuric acid (1 to 5) added to 10 cc. of this solution, the mixture warmed to 60 to 70° C. on the water bath, and decinormal potassium permanganate solution added drop by drop until the appearance of a rose-red color remaining for 5 minutes. The number of cubic centimeters of permanganate solution required for the oxidation of 1 cc. of milk, the author calls the oxidation index. As a result of numerous determinations, the following indexes were found: Cows' milk 50 to 52, goats' milk 44 to 45, sheep's milk 43 to 48, asses' milk 55 to 58, and human milk 53 to 60. The oxidation index of milk diluted with 10 per cent of water was 44, with 50 per cent 25, and with 90 per cent 5.

Note on a recent paper by R. Steinegger on the "aldehyde figure" of milk, H. D. Richmond and E. H. Miller (*Analyst, 31 (1906), No. 364, pp. 224–226*).—Steinegger's method (E. S. R., 17, p. 696) is considered important because it gives (1) an approximate estimation of the amino-nitrogen, (2) an indirect but easy method for determining proteids, and (3) another easily determined figure capable of furnishing corroborative evidence.

In mixed milk sodium hydroxid was found to give a mean aldehyde figure of 18.4 and strontium hydroxid, 20.2, expressed in cubic centimeters of normal alkali per liter of milk. Assuming a proportion of casein to albumin in milk of 7:1, the authors find that 1 cc. of tenth normal soda corresponds to 0.0298 gm. of the nitrogen of milk and 1 cc. of tenth normal strontia to 0.0271 gm. Steinegger's average was 0.0303. The maximum, minimum, and average of 113 determinations of the aldehyde number were respectively 22.6, 18.1, and 19.9, expressed in cubic centimeters of normal strontia per liter of milk.

The estimation of fat in homogenized milk, H. D. Richmond (*Analyst, 31 (1906), No. 364, pp. 218, 219*).—As homogenized milk, prepared by forcing milk under a pressure of from 200 to 400 atmospheres through very small openings, is now an article of commerce, the author sought to ascertain what effect the fine state of division of the fat globules would have upon the determination of fat by ordinary methods. The Gottlieb, kieselguhr, and Werner-Schmid methods gave results in almost perfect agreement. Good results were also secured by the Gerber method. The Adams method, however, was always low. In the opinion of the author this method, so long a standard, should be discarded in favor of the Gottlieb method, which, for ease and accuracy, is considered the best method for this purpose.

The analysis of dried milk, H. D. Richmond (*Analyst, 31 (1906), No. 364, pp. 219–224*).—Several modifications of methods used for ordinary milk considered necessary in examining dried milk or milk powder are noted and analyses of 7 samples are given.

The Werner-Schmid method is considered suitable for determining fat which can not be estimated by direct extraction. In determining milk sugar polarimetrically, 10 gm. of the sample is ground up in a mortar with sufficient hot

water to make a paste and then gradually thinned with hot water and finally made up to 100 cc. If the powder is not all dissolved a little ammonia may be added. Cane sugar is determined by the method described by Harrison (E. S. R., 16, p. 846). Proteids are calculated from the total nitrogen of the Kjeldahl method by the factor 6.87.

Two of the samples examined were apparently made from skim milk, two had received an addition of saccharate of lime, one an addition of a phosphate, two an addition of cane sugar, and one an addition of sodium carbonate. Only one sample was made without the addition of any substance designed to render the dried milk more soluble.

Determination of the proteids in milk, A. TRILLAT and E. SAUTON (*Ann. Chim. Analyt., 11 (1906), No. 6, pp. 205–207*).—Five cc. of milk is diluted with water to 25 cc., boiled for 5 minutes and treated with 5 drops of commercial formalin. After again boiling for 2 to 3 minutes and allowing to stand for 5 minutes, 5 cc. of a 1 per cent solution of acetic acid is added. The fine precipitate is then collected on a weighed filter, washed with water, and the fat extracted with acetone in a Soxhlet extraction apparatus. The fat-free material is then dried at 75 to 80° C. and weighed. The entire operation occupies less than 2 hours. The fat may be determined by evaporating the acetone. The method is applicable to milk preserved with potassium bichromate.

Estimation of casein. A preliminary study, H. V. ARNY and T. M. PRATT (*Amer. Jour. Pharm., 78 (1906), No. 3, pp. 121–128*).—In the volumetric method proposed a definite quantity (5 to 30 cc.) of milk is treated at ordinary temperatures with 20 cc. of decinormal ferric alum solution (48.1 gm. per liter), the mixture diluted with water, allowed to stand for a few minutes, filtered, the filter washed until free from iron, and the excess of ferric alum in the filtrate determined by titration with potassium iodid, hydrochloric acid, and decinormal sodium thiosulphate. The difference between the amount of ferric alum taken and that found in the filtrate gives the quantity required for the precipitation of the casein. Concordant results were obtained in numerous determinations. Experiments indicated that the reaction is not affected by the fat and sugar in the milk. Comparative determinations were made to establish a relationship between the quantity of ferric alum solution required to precipitate the casein and the nitrogen in the precipitate as determined by the Kjeldahl method, but further work is considered necessary in order to establish a definite standard.

The determination of fat in cheese, M. WEIBULL (*Svensk Kem. Tidskr., 17 (1905), No. 6, pp. 146–148*).—The author recommends the Gottlieb method for the determination of fat in cheese. The results obtained by this method were somewhat higher than those obtained by the ordinary extraction method and the Schmidt-Bondzynski hydrochloric-acid method.—F. W. WOLL.

Chemistry in the kitchen and household, G. ABEL (*Chemie in Küche und Haus. Leipsic: B. C. Teubner, 1905, pp. VI + 162, figs. 6*).—In this volume, which is designed for popular use, some of the principles of chemistry are discussed with special reference to the household. The bulk of the volume deals with the application of chemistry in the home, the special topics treated being fire, lighting and heating, cooking utensils, etc., animal foods, vegetable foods, and condiments.

Chemical department, E. F. LADD (*North Dakota Sta. Rpt. 1905, pp. 15–22*).—In addition to meteorological observations noted elsewhere, this report contains analyses of several proprietary stock foods, 3 samples of manure, and 11 of Paris green.

Report of the chemist, R. F. HARE (*New Mexico Sta. Rpt. 1904, pp. 36–46*).—This report on the work of the chemical department during the year

includes analyses of 136 samples of bat guano and 6 samples of soil. Determinations are also given of the moisture in the soil and the protein content of the wheat of 25 plats. The results are interpreted as indicating a very slight increase of protein in wheat grown on soil with a limited amount of moisture.

The chemical laboratory of the Swedish Royal Agricultural Academy, 1856–1906, H. G. Söderbaum (*Stockholm, 1906, pp. 60, figs. 6*).—A sketch of the laboratory with biographical notes of the directors, A. Müller, C. E. Bergstrand, L. F. Nilson, and the present author, and a complete bibliography of the publications of the laboratory during the past 50 years.—F. W. WOLL.

Report of the chemical control station at Trondhjem, 1905, E. Solberg (*Christiania, 1905, pp. 58*).—The report contains the usual tabular statements of the results of analyses of agricultural products made during the year, including soils, soil amendments, fertilizers, peat and peat litter, feeding stuffs, dairy products, human foods, also seed analyses.—F. W. WOLL.

METEOROLOGY—WATER.

Practical treatise on the weather, O. Freybe (*Praktische Wetterkunde. Berlin: P. Parey, 1906, pp. VIII + 173, illus.*).—This claims to be a simple explanation of the use of weather maps in connection with local weather observations.

Instructions for cooperative observers (*U. S. Dept. Agr., Weather Bur. Doc. 347, pp. 31, figs. 10*).—This is the third edition of this pamphlet, which is designed "to furnish cooperative observers with brief instructions for their guidance in taking and recording observations, more especially of temperature and rainfall."

Summaries of temperatures, rainfall, sunshine, and evaporation, E. F. Ladd (*North Dakota Sta. Rpt. 1905, pp. 16–19*).—These summaries show that the mean temperature for 1905 was 39.43° F., the maximum 93, in August, the minimum —34, in February. The total rainfall was 30.76 in. The average monthly evaporation from water surface for the 5 months May to September, 1905, was 5.29 in. A summary of observations on evaporation for the same period during the 4 years 1902–1905 shows that during 1902 the evaporation was 1.96 times the rainfall for the same period, in 1903 it was 2.58 times as great, in 1904 it was 2.47 times as great, and in 1905 the rainfall as compared with evaporation was as 1 to 1.003—that is, the evaporation was practically equivalent to the rainfall.

Studies on the diurnal periods in the lower strata of the atmosphere, F. H. Bigelow (*U. S. Dept. Agr., Weather Bur. Doc. 344, pp. 51, figs. 71*).—Articles published separately in the Monthly Weather Review, February to August, 1905, are combined in this document. The subjects treated are diurnal periods of temperature, barometric pressure, vapor tension, the electric potential, coefficient of dissipation, terrestrial magnetic field, and the aperiodic disturbances; the variable action of the sun and its effect upon terrestrial weather conditions; and a general review of the status of cosmical meteorology.

Meteorological service for forecasting weather, H. Dufour (*Chron. Agr. Vaud, 19 (1906), No. 9, pp. 276, 277*).—A brief statement regarding the organization of the meteorological service of the Swiss department of agriculture and commerce with reference to dissemination of weather forecasts, especially by means of telephones.

Meteorology of Tunis, winter of 1905–6, G. Ginestous (*Bul. Dir. Agr. et Com. [Tunis], 10 (1906), No. 38, pp. 114–128, pl. 1*).—A summary of observations on pressure, temperature, rainfall, evaporation, humidity, etc., at a large number of stations in different parts of Tunis.

A contribution to the study of spring and fall frosts, E. VANDERLINDEN (*Ann. Serv. Mét. Observ., 1905; abs. in Rev. Gén. Agron., n. ser., 1 (1906), No. 3, p. 103*).—A note is here given on studies reported in the annual report of the Meteorological Service of the Royal Observatory for 1905 of conditions under which frosts are formed in the region of Uccle and of means of predicting frosts.

The conclusion is reached that the occurrence of spring and fall frosts is determined largely by local conditions. The three principal meteorological conditions which are believed to determine the occurrence of such frosts in the region in which the observations reported were made are (1) an anticyclone covering a large part or all of Europe, (2) a low to the east or northeast and an anticyclone to the west, (3) a low to the south of Europe and a high to the north. Many other conditions have an influence in the formation of white frosts. The determination of dewpoint was found to be an unreliable indication of night frosts. The theory that there is a constant relation between the temperature shown by the wet bulb thermometer at a given hour and the minimum night temperature was not verified in these investigations, and this instrument therefore did not prove reliable as a means of predicting frosts.

Balloons and kites in the service of meteorology, W. H. DINES (*Nature [London], 74 (1906), No. 1906, pp. 35, 36*).—This is a brief summary of progress which has been made in the study of the upper atmosphere by means of balloons and kites.

Recent practice in the erection of lightning conductors, A. J. HENRY (*U. S. Dept. Agr., Weather Bur. Bul. 37, pp. 20*).—The principal contents of this bulletin are a description of the lightning conductors on the Washington Monument; the preface to the Report of the Lightning Research Committee, by Sir Oliver Lodge; the rules for the erection of lightning conductors as issued by the Lightning Rod Conference of 1882, with observations thereon by the Lightning Research Committee of 1905, and brief statements of the latest practice abroad, in Holland, Hungary, and Germany.

[Amount of nitrogen as ammonia and nitrates in rain water collected at Pretoria], H. INGLE (*Transvaal Agr. Jour., 4 (1905), pp. 104, 105; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 523, II, p. 302*).—Determinations of ammonia, nitrates, and nitrites in weekly samples of rain water collected at Pretoria during the year ended June 30, 1905, are reported. The results for the year are as follows: Rainfall 24.31 in., ammoniacal nitrogen 1.194 parts per million, nitric nitrogen 0.196 part; ammoniacal nitrogen per acre 6.587 lbs., nitric nitrogen per acre 1.083 lbs. The ammoniacal nitrogen was on the average 85.9 per cent of the total nitrogen. "The nitrogen as ammonia varied from 0.32 (week ending March 18) to 45 (week ending August 27) per million, the rainfall being 70.36 mm. and 1.06 mm., respectively. The nitrogen as nitrates varied from 0.03 to 3.75 per million (rainfall 10.08 and 0.38 mm.). Nearly the whole of the nitrogen in the rain is brought down during the growing season."

Water and the law of minimum in the fertilization of soils, L. THIRY (*Bul. Soc. Chim. Belg., 19 (1905), No. 8–9, p. 266*).—The rôle of water from the chemical, physical, biological, and electrical standpoints is discussed. Intensive culture is shown to reduce the water content of soil. This must be returned directly by irrigation or indirectly by improved methods of culture if the productive capacity of the soil is to be maintained.

Underground water resources of Long Island, New York, A. C. VEATCH ET AL. (*U. S. Geol. Survey Prof. Paper No. 44, pp. 394, pls. 34, figs. 71*).—This is a detailed report of studies of the geology and underground water conditions of Long Island, including also tests of methods of measuring velocity of underflow, data regarding wells, sizing and filtration tests, and descriptions of surface streams. It is shown that the conditions on the island are such as to cause it

to readily absorb, filter, and store the rain water, and thus to furnish large quantities of very pure water.

A study of the process of nitrification with reference to the purification of sewage, HARRIETTE CHICK (*Proc. Roy. Soc. [London], Ser. B, 77 (1906), No. B 517, pp. 241–266, fig. 1; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 522, II p. 245*).—The process of nitrification was studied in experimental laboratory filters acting both as continuous filters and contact beds. It was found that nitrification of ammonia during sewage purification occurred in two stages due to activity of two distinct classes of bacteria, one producing nitrites and the other oxidizing the nitrites to nitrates. These bacteria exist not only in the substance of the filter, but are also carried away in large quantities in the filtrates. They belong to the same group as those producing nitrification in the soil. The action of the organisms producing nitrates may be retarded when the sewage is strongly ammoniacal.

The ability of the nitrifying organisms to live and work in sewage filters so highly charged with organic matter is discussed. This is ascribed to (1) the presence of organisms in symbiosis with the nitrifying organisms, rendering the latter more resistant; (2) the retention of the organic matter in large part near the surface of the filters; and (3) the presence of very large numbers of nitrifying organisms in the filters.

The influence of temperature on the oxidation of sewage was studied, and it was observed that the efficiency of the filters and the rapidity of the process of oxidation were greatly increased by raising the temperature. In any case nitrification was extremely rapid, being completed during the time required for percolation, 2 to 3 hours. The continuous filters were more efficient than contact beds in purifying the sewage.

The purification of sewage, W. RAMSAY (*Österr. Chem. Ztg., 9 (1906), No. 10, pp. 135–139*).—This is a paper which was presented before the Sixth International Congress of Applied Chemistry, Rome, 1906, which discusses the loss of fertilizing matter, particularly nitrogen, in sewage, and the various methods of sewage disposal which have been proposed. The difficulties in the way of the successful use of the irrigation method alone are pointed out.

SOILS—FERTILIZERS.

Some peculiarities of rock weathering and soil formation in the arid and humid regions, E. W. HILGARD (*Amer. Jour. Sci., 4. ser., 12 (1906), No. 124, pp. 261–269*).—The author summarizes in this article his observations and conclusions regarding various phases of this subject, especially as regards soil formation, which have been recorded in various previous publications. It is made clear that the processes of soil formation in arid regions are very different from those operating in humid regions and show "the need of caution in applying the maxims of the humid region in arid climates."

On the changes which minerals undergo in cultivated soil, T. BIÉLER (*Bul. Soc. Nat. Agr. France, 66 (1906), No. 2, pp. 186–195*).—The author presents evidence to show that the solution of silicates in the soil is a very complex and gradual process, resulting in partial or total decomposition of these compounds under the action of various factors working in association. Among these factors, which are enumerated and discussed, are chemical decomposition, and the solvent action of air and water, of organic matter, roots, and micro-organisms.

The wire-basket method for determining the manurial requirements of soils, F. D. GARDNER (*U. S. Dept. Agr., Bur. Soils Circ. 18, pp. 6, figs. 2*).—The methods of constructing the wire baskets and of using them in determining the manurial requirements of soils are described (see E. S. R., 17, p. 227).

Soil analysis and agricultural charts in Italy, G. Fascetti (*Abs. in Ztschr. Angew. Chem., 19 (1906), No. 20, pp. 913, 914*).—The need of systematic soil examination and charting is pointed out. It is claimed that this work should be done with the aid and under the supervision of the Ministry of Agriculture in order to secure uniformity of methods and results.

The soils of Victoria, T. Cherry (*Year Book Agr. Victoria, 1905, pp. 29–44*).—The physical features of Victoria with especial reference to soils are briefly described, and analyses of 190 samples of typical soils are reported and discussed. The average results of the analyses are given in the following table in comparison with typical English and American soils:

Average composition of Victorian and other soils.

	Number of samples.	Soils.					Subsoils.				
		Nitrogen.	Phosphoric acid.	Potash.	Lime.	Chlorin.	Nitrogen.	Phosphoric acid.	Potash.	Lime.	Chlorin.
Victorian soils:		*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Clay soils	30	0.149	0.063	0.205	0.176	0.010	0.100	0.066	0.232	0.155	0.008
Northern plain	34	.112	.061	.422	1.072	.009	.089	.060	.706	2.487	.020
Coastal plain	85	.178	.061	.185	.903	.007	.106	.046	.247	.380	.013
Volcanic	24	.272	.061	.277	.588	.017	.103	.042	.170	1.649	.006
Mallee	5	.113	.047	.380	2.426	.007	......	......	......	......	......
Drained swamps	8	.750	.076	.263	.315	.040	.191	.031	.154	.121	.019
England, typical soils	10	.175	.098	.463	......	......	......	......	......	......	......
American soils:											
Arid	466	......	.117	.729	1.362	......	......	......	......	......	......
Humid	313	......	.113	.216	.108	......	......	......	......	......	......
Sand	......	......	.128	.157	.115	......	......	.124	.143	.096	......
Clay	......	......	.207	.214	1.761	......	......	.159	.344	1.481	......

The characteristics of the soils of the different classes are quite fully described. In general it was found that judged by European standards the amount of fertilizing matter in Victorian soils is often small, but "the marvelous growth that occurs everywhere when the rain comes after a dry spell shows that there are forces at work during the months of bright sunshine which are very friendly to the husbandman." Small applications of superphosphate sometimes prove beneficial, but applications of nitrogen in many cases actually reduce the yield.

Some preliminary notes on the physical properties of the soils of the Ganges Valley, more especially in their relation to soil moisture, H. M. Leake (*Jour. Agr. Sci., 1 (1906), No. 4, pp. 454–469*).—This article reports a series of observations extending over about one year with reference to the temperature, moisture, and other conditions under which indigo is grown on these soils, with the ultimate object of finding means of rendering these as favorable as possible. Observations on rainfall, temperature, humidity, methods of cultivation, general physical properties of the soils, and studies of specific gravity and soil moisture (to a depth of 8 inches) and its movement are reported, and bring out the following points:

"(1) A large daily evaporation is taking place from the surface of the soil.

"(2) This evaporation is entirely, or in greater part, counteracted by a large upward flow of moisture from a lower level and ultimately from the ground water."

Some banana soils of St. Mary and Upper St. Catherine [Jamaica], H. H. Cousins (*Bul. Dept. Agr. [Jamaica], 4 (1906), No. 2, pp. 25–33*).—The results of examinations with reference to mechanical condition and percentages of lime as carbonate and humus soluble in ammonia of 39 samples of typical

banana soils are reported, and the condition and needs of the soils are discussed. The examinations were limited to the three points named because previous analyses and experiments had indicated that the soils are not in present need of commercial fertilizers, but require special attention to drainage and humus and in some cases lime.

The lime content of some esparcet soils, F. G. STEBLER (*Landw. Jahrb. Schweiz, 20 (1906), No. 3, pp. 177–180*).—Examinations of a number of soils on which esparcet was grown show that this and like plants can be successfully grown only on soils containing very small amounts of calcium carbonate and of good physical properties.

Regeneration of overlimed soil, S. MAKI and S. TANAKA (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 61–65, fig. 1*).—Pot experiments with barley are reported which indicate that only one-twentieth as much magnesia (MgO) in sulphate as in magnesite is needed to bring about favorable conditions for barley on overlimed soil.

On the formation of humus, S. SUZUKI (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 95–99*).—Observations on decomposition of oak leaves in flasks under different conditions show "that magnesium carbonate promoted the development of carbonic acid, while calcium carbonate retarded it," and lead to the conclusion that "the humification process is promoted by magnesium carbonate and retarded by calcium carbonate." The addition of soluble phosphate overcame in a measure the retarding action of the calcium carbonate. An examination of the physical and microscopic properties of the leaves indicated that "the change in color and brittleness and also the development of mycelium go parallel with the development of carbonic acid. . . .

"After sterilization and introduction of the peculiar kind of Penicillium known thus far only under the name of 'Schokoladenfarbener Schimmelpilz' the humification process proceeded much slower than under the original conditions."

Plant nutrition studies, E. B. VOORHEES and J. G. LIPMAN (*New Jersey Stas. Rpt. 1905, pp. 211–221, pls. 6*).—The methods and appliances devised for "a comprehensive study, first, of the needs for plant food of certain rather well-defined soil types, when used for general farming; and second, the mineral requirements in the growth and development of legumes" are described, and the first year's results with cowpeas, oats, and oats and cowpeas on red shale soil classed as (1) good (producing 20 bu. of wheat per acre), (2) medium (producing 15 bu. of wheat), and (3) poor (producing 10 bu.) are reported.

"While these studies were carried out by means of the pot system, in which small amounts of soil are used under controlled conditions, the system used varied somewhat from that generally practiced in work of this character, where the pots are carried on trucks, which may be run to shelter during showers or rainy weather. The system adopted avoided the removal of the pots from the open air at any time, prevented an undue raising of the temperature, as the surfaces of the pots were not directly exposed to the atmosphere, and provided an easy means of weighing for controlling the amount of water added. The system may be described as follows: . . . In the first place, a framework was erected, 3 ft. high, 3 ft. wide, which was enclosed with matched boards, with openings on the top for insertion of the pots. . . .

"In order to protect the jars from heat radiated from the covering of the frame, boards were nailed to cleats on the inside, thus providing an air space between the jars and the outside covering.

"An iron ring of the same diameter as the hole for the jar was placed on the top of the box for each jar, in order to facilitate weighing the jars without

removing them from the box. This, together with the balance used, is shown in figure 1. The jars were the ordinary museum jars, without tops, having an extended flange at the top, serving as a support for the jar, though the cross-pieces were carried through the frame under the boxes in order to relieve any sudden strain upon the flange. These jars were 7¼ in. in diameter and 10 in. deep. They were all tared by adding small quartz pebbles, and each contained exactly 20 lbs. of soil. In order to protect the plants from high winds and from rain, a detachable roof was made by a framework, hinged in the middle and covered with duck. In order to provide for the growth of the plants stakes were fastened to the sides of the frame, with holes bored in them at different distances. The roof could, by this device, be adjusted at different heights, and was held in place by means of iron staples."

The detailed results of studies of the effect of small, medium, and large amounts of potash and phosphoric acid on the growth of the cowpeas and of small, medium, and large amounts of potash, phosphoric acid, and nitrogen on oats are reported, but no conclusions are drawn.

"The experiments begun in Hammonton in 1904, to study methods of development of the light soils, as well as their adaptability for the growing of forage crops, were continued through the present year." The object in the first case is "to grow profitable forage crops, in succession, by the use of commercial fertilizer alone." Data are given for crops of crimson clover followed by soy beans, rye

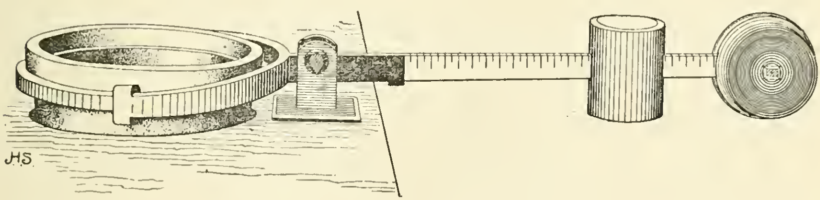

FIG. 1.—Balance for weighing soil pots.

and vetch followed by corn, red clover followed by millet, wheat followed by cowpeas, and oats and vetch grown in 1905.

The measure of soil fertility from the nitrogen standpoint, J. G. LIPMAN (*New Jersey Stas. Rpt. 1905, pp. 225–280*).—This is a review and contribution to the study of the biological activities of the soil bearing upon the various processes of nitrogen fixation, decay, nitrification, and denitrification, each of which plays a certain rôle in the nitrogen feeding of the crop, with a view to finding means "to intensify the desirable processes of nitrogen fixation and nitrification; to suppress the objectionable denitrification, where it is at all apt to take place; to suppress, likewise, the too rapid oxidation of the organic matter, and those phases of decay that might lead to the liberation of elementary nitrogen."

Series of studies of ammonia production in peptone solution inoculated with soils of different kinds fertilized in various ways and of experiments with Azotobacter cultures isolated at various times in 1903, 1904, and 1905 are reported.

"The cultures of *Azotobacter vinelandii*, isolated at the beginning of 1903 and kept in the laboratory since that time, were found to have lost none of their nitrogen-fixing power. A similar comparison of fresh cultures of *A. beyerincki* with those isolated a year earlier showed that also this species had retained its original power of fixing atmospheric nitrogen. As to the quantitative production of combined nitrogen, *A. vinelandii* is markedly superior to either *A. beyerincki* or *A. chroococcum*, with an output frequently more than double that

produced by either of the other species. *A. beyerincki* and *A. chroococcum*, while quite different in their cultural characteristics, are physiologically alike in so far, at least, as their power of nitrogen fixation is concerned. Like *A. vinelandii*, these two species may also increase their output of combined nitrogen when growing together with certain smaller bacilli."

Investigations on the biology of nitrogen-fixing bacteria: A contribution to the knowledge of the variations in nitrogen content of bare soils, II. WARMBOLD (*Landw. Jahrb., 35 (1906), No. 1–2, pp. 1–123; abs. in Chem. Centbl., 1906, I, No. 12, p. 1041*).—In this article the author reviews with considerable fullness previous investigations on denitrification and nitrogen fixation in the soil, discusses the general conditions controlling such changes in nature, and reports a series of experiments on the influence of temperature, water content, aeration, associative action of pure and mixed cultures, etc., on these processes.

The principal conclusions drawn from the results obtained are as follows: Sterilized soils of very porous structure, containing 16 to 30 per cent of water, when subjected to thorough aeration fixed nitrogen to an appreciable extent, indicating that under certain conditions there is a chemical fixation of nitrogen in the soil without intervention of organisms. This is in agreement with results obtained by Berthelot. The increase in nitrogen of both sterile and unsterilized soils was dependent to a considerable extent upon the temperature. The water content of thin layers of porous soils in which aeration was not interfered with exerted no appreciable influence on the nitrogen content of the soil. In pot experiments with larger amounts of soil (about 13½ kg.) the water content exerted a very appreciable influence. In such cases the most desirable water content from the standpoint both of preservation and increase of nitrogen in the soil was 20 per cent. With 10 per cent and less there was either no increase or a very decided decrease of soil nitrogen, the loss of nitrogen being especially large in case of the lighter soils. The loss of nitrogen with a water content of less than 3 per cent can not be ascribed to denitrification, but must be due to some purely chemical process, since nitrates were not present at the beginning of the experiment and the nitrifying organisms could not develop with so small a water content.

The growth of algæ on the surface of the soil favored an increase of nitrogen in the soil, but it is not clear whether this was due to nitrogen assimilation by the algæ or to their influence in retarding denitrification. With large amounts (about 3 kg.) of sterile soils a water content of 3 to 20 per cent did not influence the nitrogen content. With a water content of 30 per cent, however, a loss was observed. No influence of aeration on the nitrogen content of soils was observed in case of small amounts (150 gm.) of soils in thin porous layers either in sterile or in unsterilized condition. In pot experiments with about 13½ kg. of soil and 15 per cent of moisture thorough aeration increased the nitrogen content.

The use of artificial humus favored the fixation of nitrogen, indicating that this material is a suitable source of carbon in artificial culture media for soil bacteria. With a temperature of less than 5° C. or greater than 50° C. there was no fixation of nitrogen in the artificial cultures. The most favorable temperature zone for nitrogen fixation in artificial cultures lies between 18 and 31° C. Wide variations were observed in the capacity for fixation of nitrogen of the various organisms experimented with, both in pure cultures and in mixed cultures. In artificial cultures of azotobacter weak diffused light appeared to exert a favorable influence upon nitrogen assimilation.

Some work of the Agricultural-Bacteriological Institute of Göttingen University, A. KOCH (*Mitt. Deut. Landw. Gesell., 21 (1906), No. 10, pp. 111–115*).—A brief review is given of recent investigations at this institute on

nitrogen-fixing bacteria, the influence of carbon bisulphid in increasing the yield of crops, green manuring, solvent action of bacteria on phosphatic fertilizers, and a source of error in estimating the yield of cereals.

The author's experiments show that the activity of the nitrogen-fixing bacteria is controlled more by the temperature of the soil than by the nutrient materials available. For example, in soil supplied with sugar and kept at a temperature of 7° C. there was no fixation of nitrogen. When, however, the temperature was raised to 15, or better, 24°, there was rapid fixation of nitrogen. Moreover, in presence of substances such as sugar, which promote the action of the denitrifying organisms, denitrification is more likely to prevail at the lower temperatures than at the higher. Raising the temperature apparently enables the nitrogen-fixing organisms to overcome the denitrifying organisms.

Observations on the effect of carbon bisulphid on the organisms of the soil indicate that the use of large quantities of this material does not prevent denitrification, a result which does not bear out Hiltner and Störmer's explanation of the action of this substance in increasing the yields of crops.

Experiments are reported which show that the turning under of mustard as a green manure resulted in a loss of nitrogen from the soil, the cause of which was not ascertained.

The author's investigations confirm those of Stoklasa in showing that soil bacteria and other lower organisms produce acids in the soil which aid in dissolving and rendering assimilable the difficultly soluble phosphates.

Data are reported to show that the appearance of crops in the field is by no means an accurate index of their actual yield when harvested.

On the question whether nitrites or nitrates are produced by nonbacterial processes in the soil, E. J. Russell and N. Smith (*Jour. Agr. Sci.*, *1* (*1906*), *No. 4*, *pp. 444–453*).—The experiments reported in this article "were made with a view to discover how far purely physical and chemical processes, known to take place in the soil, may be expected to give rise to nitrites and nitrates." They dealt with the possibility of the formation of nitrites and nitrates during (1) the evaporation of water, (2) the oxidation of free nitrogen by catalytic processes and induced oxidation, and (3) the oxidation of ammonia. The first dealt mainly with a study of Schönbein's observations, from which he concluded that ammonium nitrite is produced when water is evaporated in air; the second with the catalytic action of platinum black as studied by Loew, ferric oxid as studied by Bonnema, humus, and soil; and the third with the oxidation of ammonia in the soil by catalytic action and induced oxidation.

The results as a whole are claimed to show conclusively that there is no measurable formation of nitrites or nitrates in the soil from atmospheric nitrogen or from ammonia by chemical or physical processes and that under no circumstances does the evaporation of water produce ammonium nitrite. The evidence as to the oxidation of free nitrogen by catalytic or induced oxidation processes in the soil is not conclusive, but the results obtained in the experiments reported indicate "that if induced oxidation takes place at all its effects are so extremely slight that in practice they would be altogether negligible.

"Catalytic oxidation of nitrogen does not seem to occur in the soil.

"Slightly different results were obtained with ammonia. As the higher oxids of iron and manganese possess a slight power of catalytically oxidizing ammonia, it might be expected that soils in which they occur to any extent would possess the same power; in any case, however, the effect is only small, and appears to be of no practical consequence.

"On the other hand, ammonia oxidizes more readily in presence of other sub-

stances undergoing oxidation. Experiments with soils showed that this induced oxidation may, under certain rather artificial circumstances, come into play as a factor in producing nitrates; but it must be remembered that at the low partial pressures of ammonia obtaining in nature, bacterial nitrification would be more prominent than in our experiments. Taking this point into consideration, the induced oxidation of ammonia can not be regarded as an important source of nitrates under natural conditions."

The fixation of atmospheric nitrogen during the decomposition of forest leaves, L. MONTEMARTINI (*Staz. Sper. Agr. Ital., 38 (1905), No. 10–12, pp. 1060–1065*).—Carefully conducted experiments with 50 to 60 gm. lots of plane-tree, alder, hornbeam, and oak leaves sterilized and inoculated with extracts of decomposing leaves showed a considerable gain of nitrogen in the course of decomposition during the period from about the end of November to the last of March, thus confirming Henry's claim (E. S. R., 9, p. 1041; 15, p. 764) that during the process of decomposition of the leaves of trees there is a fixing of atmospheric nitrogen and that such fixation does not take place when the material studied is sterilized, thus signifying that the phenomenon is due to the presence of micro-organisms.

Investigations relative to the use of nitrogenous materials, E. B. VOORHEES and J. G. LIPMAN (*New Jersey Stas. Rpt. 1905, pp. 138–211*).—The experiments of previous years (E. S. R., 17, p. 344) were continued during 1904 and 1905, the crop grown in this year being oats. "The two oat crops of the first rotation added to those of the second rotation furnish an abundance of experimental material, which may be used to demonstrate how a one-sided system of fertilization affects the crop-producing power of the soil. It becomes clear here what the comparative value of nitrate, ammonia, or organic nitrogen may be and to what extent they may be used as a source of nitrogen when applied alone or together with animal manures."

The relative availability of the nitrogen of the nitrogenous materials, as shown by the four crops of oats, is given in the following table:

The availability of nitrogen in different nitrogenous materials with oats.

	1899.	1900.	1904.	1905.
Sodium nitrate	100.0	100.0	100.0	100.0
Ammonium sulphate	77.9	87.7	64.7	78.1
Dried blood	61.3	73.1	65.2	53.5
Solid manure, fresh	43.1	26.4	48.6	33.2
Solid manure, leached	46.4	22.0	40.3	42.7
Solid and liquid manure, fresh	88.4	51.5	71.0	37.8
Solid and liquid manure, leached	33.0	35.9	52.9	42.3

On the direct utilization of the nitrogen of the air for the preparation of fertilizers and other chemical products, A. FRANK (*Ztschr. Angew. Chem., 19 (1906), No. 19, pp. 835–840; Chem. Ztg., 30 (1906), No. 38, p. 449*).—A paper before the Sixth International Congress of Applied Chemistry at Rome, 1906, which reviews the history of investigation and invention in relation to this subject, the progress made in establishment of manufacturing enterprises, as well as experiments to test the value of the product for industrial and agricultural purposes.

Comparative fertilizer tests of lime nitrogen and nitrate of soda on oats, R. OTTO (*Deut. Landw. Presse, 33 (1906), No. 32, p. 275*).—The two materials were applied on light soils in amounts furnishing equal rations of nitrogen. The lime nitrogen was applied about one week before the seeding of the oats.

The results were in all cases favorable to the lime nitrogen except that the grain produced with this fertilizer contained a somewhat smaller percentage of nitrogen than that produced with nitrate of soda.

Calcium cyanamid and calcium nitrate, two new fertilizers derived from atmospheric nitrogen, and results of their use, H. VON FEILITZEN (*Österr. Moor. Ztschr., 7 (1906), p. 38; abs. in Chem. Ztg., 30 (1906), No. 34, Repert. No. 12, p. 143*).—The fertilizing value of these materials is discussed, especial attention being given to the results of tests of hygroscopic and basic calcium nitrate in comparison with sodium nitrate. It was found that these materials were about equally effective as fertilizers.

A new nitrogenous manure, lime nitrogen or calcium cyanamid, J. HENDRICK (*Trans. Highland and Agr. Soc. Scot., 5. ser., 18 (1906), pp. 75–77*).—Comparative tests of calcium cyanamid, nitrate of soda, and sulphate of ammonia in pot and field experiments with oats and barley are reported. "The results show that the cyanamid gives returns very little behind those given by nitrate of soda or sulphate of ammonia."

Experiments with lime nitrogen as a fertilizer for sugar beets, F. STROHMER (*Österr. Ungar. Ztschr. Zuckerindus. u. Landw., 34 (1905), pp. 661–685; abs. in Chem. Centbl., 1906, I, No. 9, p. 781*).—When applied 15 days before planting, the lime nitrogen produced no injurious effects and proved but little less efficient than sodium nitrate and superior to ammonium sulphate both as regards yield and quality of beets.

Experiments on the action of nitrogen lime, O. BÖTTCHER (*Deut. Landw. Presse, 33 (1906), No. 34, pp. 289, 290*).—Pot experiments on oats with so-called nitrogen lime (*Stickstoffkalk*), which is prepared by passing atmospheric nitrogen freed from oxygen over a fused mixture of calcium carbid and calcined calcium chlorid and containing about 22 per cent of nitrogen, are reported. The results show that this material is very similar in its action to calcium cyanamid (lime nitrogen), that like it it should not be used as a top-dressing, and should be applied some time before planting seed.

Lime nitrogen, B. SJOLLEMA (*Cultura, 18 (1906), Nos. 209, pp. 3–27; 210, pp. 90–97*).—Investigations on the fertilizing value of lime nitrogen are quite fully reviewed and experiments by the author on rye and oats are reported which show that the lime nitrogen (180–270 lbs. per acre) was as a rule nearly as efficient as nitrate of soda and somewhat more so than sulphate of ammonia. A mixture of 134 lbs. of lime nitrogen and 180 lbs. of nitrate of soda per acre gave the highest increase in yield in case of rye.

The results of experiments with calcium cyanamid (lime nitrogen), A. POZZOLI (*Abs. in Chem. Ztg., 30 (1906), No. 38, p. 454*).—This is an abstract of a paper presented at the Sixth International Congress of Applied Chemistry at Rome in 1906, reviewing the results of tests by various investigators of the fertilizing value of this material. It is pointed out that the results of a large number of experiments show that the action of this material varies widely with different plants.

Experiments by Frank are cited to show that the injurious effects observed in the use of lime nitrogen as a top-dressing in pot experiments would not be observed in practice where much smaller amounts of the material would be used. Experiments by the same investigator also indicate that the fear of injury from acetylene gas, which may be generated in small amounts when lime nitrogen is applied to soils, is groundless. Experiments with various plants showed no injury from the presence of this gas.

The various factors which influence the decomposition of calcium cyanamid, J. STOKLASA (*Abs. in Chem. Ztg., 30 (1906), No. 38, p. 455*).—This is an

abstract of a paper presented at the Sixth International Congress of Applied Chemistry at Rome, 1906, dealing especially with the water and air capacity of cultivated soils in its relation to the bacteriological decomposition of calcium cyanamid in the soil. It is noted especially that in humus soils, in which the nitrification process goes on very slowly, calcium cyanamid shows very little effectiveness as fertilizer.

Vegetation experiments with "N" fertilizer in the year 1905, von Lepel (*Mitt. Deut. Landw. Gesell., 21 (1906), No. 3, pp. 19–24, figs. 5*).—A series of field and pot experiments with this material on various crops is reported.

Previous experiments (E. S. R., 16, p. 860) having shown no injurious effects with the amounts of "N" fertilizer used, field experiments with rye, oats, wheat, potatoes, and beets, and pot experiments with barley, oats, maize, timothy, buckwheat, mustard, and flax were undertaken in 1905 to further study the limits of efficiency of this material as a fertilizer.

The results confirmed those of previous years in showing a high fertilizing efficiency for the "N" fertilizer on cereals and like crops (at rates of 50 lbs. per acre). Its value for hoed crops is, however, less certain.

Green manuring experiments in 1905, Baessler (*Mitt. Deut. Landw. Gesell., 21 (1906), No. 22, pp. 233–237*).—Plat experiments which have been carried on in various localities for several years to determine (1) the best depth to which to plow under green manures, (2) the relative merits of spring and fall green manuring, (3) the utilization of the nitrogen of green manures by the following crop, are reported. Shallow plowing under (10 to 15 cm.) gave in general the best results. Spring green manuring appeared to be as a rule more effective than fall. The utilization of the nitrogen and the general effect of the green manure was found to vary widely with conditions of soil, season, etc.

Experiments with fertilizers, J. H. Stewart and H. Atwood (*West Virginia Sta. Bul. 99, pp. 185–210, pls. 6*).—The results of 6 years' experiments with various kinds and combinations of fertilizing materials on tenth-acre plats on the station farm are summarized.

Mechanical and chemical analyses of the soil are reported. These show no striking peculiarities as regards chemical composition, but that the soil is a clay loam fairly well supplied with fertilizing constituents. The crops grown during the different seasons included rye, clover, wheat, corn, and cowpeas

The results show that the yields were uniformly increased by applications of phosphoric acid. The only case in which nitrogen was beneficial was in the form of nitrate of soda applied as a spring top-dressing on rye. Potash in form of sulphate was of little or no value, and a mixture of potash and nitrogen gave like results. The indications are that the stock of available phosphoric acid in the soil is so low that this deficiency must be supplied before either nitrogen or potash can be of any particular value, and after the deficiency of phosphoric acid is supplied the plants feel the lack of nitrogen more than that of potash. Stable manure increased the yields materially and uniformly. The results of applications of lime were totally unsatisfactory, in many cases reducing the yield. In general it was observed that the fertilizer combination which gave good results with one crop in the series tested also gave good results with the others. That is, a fertilizer containing phosphoric acid gave good results with all of the crops tested. In a comparison of the effects of commercial fertilizers and barnyard manure it was found that corn responded more favorably to a dressing of stable manure than it did to an application of commercial fertilizers, while with cowpeas the opposite was true. It was observed also that although the roots of the cowpeas were well supplied with nodules, the yield was slightly increased by adding nitrate of soda to the fertilizer mixture applied.

In general it is held that "this experiment shows that this soil is very deficient in available phosphoric acid, and that as soon as this deficiency is supplied then there is a lack of nitrogen and to a less extent of potash also. When commercial fertilizers are relied upon entirely to maintain a high degree of crop production a fertilizer containing all three constituents—nitrogen, potash, and phosphoric acid—will give better results than a fertilizer containing only one or two of these constituents. . . .

"If leguminous crops are raised and either plowed under or fed on the farm and the resulting manure carefully saved and applied to the soil it is very probable that in practice it will be necessary to purchase only phosphoric acid in order to increase the productiveness of soils of this type and to maintain them in a condition of high fertility.

"Stable manure has demonstrated again its great value as a restorer of fertility to a poor worn-out soil."

Results of cooperative experiments with fertilizers on swamp soils, R. Harcourt (*Ann. Rpt. Ontario Agr. and Expt. Union, 27 (1905), pp. 33–35*).—The results of 11 cooperative experiments with oats and 7 with corn on swamp soil in different parts of Ontario are briefly reported. Potash (muriate) produced an increase in yield in every case and Thomas slag gave an increase in every case except two, the increase being in every case sufficient to make the use of fertilizers profitable.

Comparative tests of Peruvian guano and ammoniated superphosphate 9:9, A. Arnstadt (*Deut. Landw. Presse, 33 (1906), No. 19, pp. 159–161*).—Experiments of previous years (E. S. R., 16, p. 758) were continued with oats and fodder beets. The results for 3 years are partly summarized, showing a high fertilizing value for the Peruvian guano as compared with the ammonium superphosphate.

The action of ammoniacal nitrogen as a fertilizer, T. Pfeiffer (*Fühling's Landw. Ztg., 55 (1906), No. 5, pp. 153–159*).—Various causes for the frequently observed inferiority of ammoniacal nitrogen to nitrate nitrogen as a fertilizer are discussed. It is claimed that there are so many unknown factors causing wide variations in the efficiency of ammoniacal nitrogen that the only safe plan is for the farmer to make field experiments to test the matter for himself.

On the use of commercial nitrogen in connection with barnyard manure, Bachmann (*Fühling's Landw. Ztg., 55 (1906), No. 5, pp. 180–183*).—The conditions under which it is advisable to supplement farm manures with the more active commercial forms of nitrogen are discussed.

The use of waste organic substances as manures, E. J. Russell (*Jour. Bd. Agr. [London], 13 (1906), No. 2, pp. 65–72*).—This article deals briefly with the use as fertilizer of dried blood, feathers and feather waste, greaves (refuse from making tallow or soap grease), hair, hoofs and horns, rabbit flick (rabbit waste, consisting of ears, feet, tail, etc.), slaughterhouse refuse, waste fish, damaged oil cake, shoddy, refuse from tanneries, destructor refuse, night soil and poudrette, and sewage sludges.

Action of phosphoric acid on higher plants and a new nutritive solution, C. von der Crone (*Inaug. Diss. Bonn, 1904; Naturw. Rundschau, 1905, p. 264; abs. in Centbl. Agr. Chem., 35 (1906), No. 1, pp. 30–33; Jour. Chem. Soc. [London], 90 (1906), No. 521, II, pp. 191, 192*).—Water culture experiments with different plants are reported which showed that when phosphoric acid was absent the root development was retarded and the roots were yellow when iron (as sulphate) was present. The addition of phosphate precipitated the iron and prevented its injurious action, but in this case the plants suffered from chlorosis. Good results were obtained when ferrous phosphate and tricalcium phosphate were added to the solution. When dicalcium phosphate was

used the plants were chlorotic and the root development was retarded. The author believes that the assumption that the constituents of the culture medium should all be in solution is incorrect. He recommends the following solution: Potassium nitrate 1 gm. per liter, calcium sulphate and magnesium sulphate each 0.5 gm., ferrous phosphate and tricalcium phosphate each 0.25 gm.

On phosphoric acid of ashes, D. N. PRIANISHNIKOV (*Abs. in Chem. Ztg., 30 (1906), No. 37, p. 439*).—This is an abstract of a paper presented at the Sixth International Congress of Applied Chemistry at Rome, 1906, in which pot experiments are reported which show that the phosphoric acid of straw ashes is nearly as effective as that of soluble phosphates, the phosphoric acid of birch wood ashes is somewhat less effective, and that of fir wood ashes still less effective. (See also E. S. R., 17, p. 847.)

Analysis of deposits of calcium phosphate in the United States, P. JUMEAU (*Ann. Chim. Analyt., 11 (1906), No. 5, pp. 167–170*).—The location, extent, and composition of the hard rock deposits of Florida are discussed in this article. The following complete analyses of two samples of ground phosphate are given as representing the composition of products of good quality:

Composition of Florida hard rock phosphate.

	A.	B.
	Per cent.	*Per cent.*
Moisture	1.80	1.08
Loss at red heat	1.10	1.10
Phosphoric acid	[a]35.44	[b]35.82
Lime	47.30	47.47
Iron oxid	.70	.72
Alumina	1.60	1.48
Silica and insoluble	3.70	5.30

[a]Corresponding to calcium phosphate, 77.43 per cent.
[b]Corresponding to calcium phosphate, 78.26 per cent.

The utilization of sugar beet slump by the Dessau method, H. OST (*Ztschr. Angew. Chem., 19 (1906), No. 14, pp. 609–615, figs. 4*).—The preparation of cyanids, ammonium sulphate, and other products from this material is briefly described. It is shown that in general about one-half of the nitrogen of the slump is utilized by the various processes described, one-fourth as sodium cyanid and about an equal amount as ammonium sulphate.

History of the fertilizer industry, J. RUHM, Jr. (*Bien. Rpt. Tenn. Dept. Agr., 1903–4, pp. 205–217, fig. 1*).—A brief general summary of the history of the phosphate industry in Tennessee, containing also notes on geology, location and description, and mining of the phosphates.

The chemical fertilizer industry, L. SCHUCHT (*Die Chemische Düngerindustrie. Brunswick: Friedrich Vieweg & Son, 1906, pp. VII + 164, figs. 27*).—This is practically a summary intended for young chemists of the author's earlier work on the manufacture of superphosphates, the second edition of which was published in 1903. It deals with the preparation of bone meal for fertilizing purposes, superphosphates, double superphosphates, Thomas slag, dicalcium phosphate, industrial by-products, and atmospheric nitrogen, and gives methods of analysis of fertilizers, with various tables useful in connection with such work.

Commercial fertilizers, A. GOSS and W. J. JONES, Jr. (*Indiana Sta. Bul. 112, pp. 135–208*).—This bulletin gives the text of the State fertilizer law, with explanations as to how the law is administered and terms used in fertilizer

analyses, statistics of fertilizer sales in different sections of the State, and results of analyses of 308 samples of fertilizers collected during the spring of 1905 and 426 samples collected in the fall of 1905.

Analyses of commercial fertilizers, M. A. SCOVELL ET AL. (*Kentucky Sta. Bul. 123, pp. 191–223*).—Analyses and valuations of 151 samples of fertilizers inspected during 1905 are reported.

Analyses and valuations of fertilizers, J. P. STREET, W. P. ALLEN, and V. J. CARBERRY (*New Jersey Stas. Rpt. 1905, pp. 15–76*).—This is a reprint of matter contained in Bulletins 187 and 188 of the station (E. S. R., 17, pp. 450, 846), with the addition of a list of manufacturers whose goods were sampled and analyzed during 1905, and data relating to the wholesale prices of fertilizing materials in New York during different months of the year 1904 and valuations for 1905.

Fertilizer analyses, fall season, 1905, and spring season, 1906, B. W. KILGORE (*Bul. N. C. Bd. Agr., 27 (1906), Nos. 3, pp. 48; 4, pp. 48*).—The names and guaranteed composition of fertilizers registered for 1906, and analyses and valuations of 230 samples of commercial fertilizers and 39 samples of cottonseed meal, examined during the fall of 1905 and spring of 1906, with explanations regarding terms used in fertilizer analyses, freight rates, valuation, etc.

Analyses of commercial fertilizers (*Bien. Rpt. Tenn. Dept. Agr., 1903–4, pp. 37–77*).—The results of fertilizer inspection in the State during 1903 and 1904 are reported, with the text of the State fertilizer law and the rules and regulations adopted in accordance with the law.

Standard fertilizers, 1906, T. MACFARLANE (*Lab. Inland Rev. Dept. [Canada] Bul. 118, pp. 19*).—Analyses of 153 samples of fertilizers inspected during the year are reported and briefly discussed. Attention is called to an apparent tendency toward increased use of low-grade fertilizers, and it is pointed out that this is poor economy.

Fertilizers, J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 66 (1905), pp. 153–159*).—Analyses of slag, steamed bones, soot, lime, mustard cake, poultry manure, feather waste, and other barnyard manures are reported and briefly commented upon. Nitrogen (2.19 and 3.72 per cent) and siliceous matter (51.36 and 19.34 per cent) in 2 samples of soot are reported. The first, as the analysis shows, was fully one-half ashes and similar matter, while the second is considered of good quality.

Analyses of one sample each of poultry manure and feather waste are reported. The poultry manure contained 62.5 per cent of water, 0.83 per cent of lime, 2.13 per cent of "alkalis, etc.," 0.65 per cent of phosphoric acid, and nitrogen equal to 1.93 per cent of ammonia; the feather waste contained 9.12 per cent of water, 1.25 per cent of lime, 2.74 per cent of "alkalis, etc.," 1.4 per cent of phosphoric acid, and nitrogen equal to 12.08 per cent of ammonia.

The use of chemical fertilizers in Belgium during the decennial period 1895–1905, M. BERGER (*Rev. Gén. Agron., n. ser., 1 (1906), No. 3, pp. 98–101*).—The consumption of unmixed fertilizers in Belgium in 1904 is stated to be 307,676 metric tons (2,200 lbs.), an increase of 83.8 per cent over that of 1903. The consumption of mixed fertilizers was 70,002 metric tons, an increase of 4.6 per cent over that of 1903.

Production and commerce in basic slags in Belgium (*Rev. Gén. Agron., n. ser., 1 (1906), No. 3, pp. 127, 128*).—This is a brief review of a report published by the Minister of Public Works of Belgium, showing that this country produces about 225,000 tons of Thomas slag annually, 210,000 tons of which is ground for use as fertilizer. About three-fourths of the total product of the country is exported to foreign countries. The slag contains on an average 18 to 20 per

cent of phosphoric acid and is ground so that not less than 75 per cent of it will pass a sieve having 0.17 mm. meshes.

AGRICULTURAL BOTANY.

Agricultural botany, E. Schribaux and J. Nanot (*Botanique Agricole. Paris: J. B. Baillière & Sons, 1906, pp. XI + 376, figs. 294*).—This work, which is a part of the Agricultural Encyclopedia issued by the publishers, is a general treatise on the subject of botany, in which the morphology, physiology, anatomy, etc., of the different parts of plants are described, and special chapters are given on the preservation of agricultural products, their improvement by breeding and selection, etc.

Native economic plants of Montana, J. W. Blankinship (*Montana Sta. Bul. 56, pp. 38*).—The object of this bulletin is to enumerate, so far as possible, the native plants of the State utilized by the Indians, the early explorers, trappers, and settlers, as well as to mention the chief species now employed in our own industrial life. The lists are given arranged alphabetically according to the scientific names. Additional lists are given grouped according to their use in various arts, as foods, medicines, etc.

Report of the botanist, H. L. Bolley (*North Dakota Sta. Rpt. 1905, pp. 23–32*).—The investigations of the botanist have been confined largely to studies on wheat, flax, potatoes, grass, and native plants, breeding and selection for resistance being prominent items in his work.

Attention is called to some of the results of selection for resistance to wheat rust, and the discovery of uredo and teleutospores in the grains of shriveled samples of durum and fife wheats is noted. Thus far attempts to propagate the rust from these infested grains have failed, but the occurrence of these spores in the seed is believed to offer a possible explanation for the wintering of the rust.

In connection with the author's studies on the wilt of flax, immune strains have been found that seem to be quite resistant to the wilt, but during the season's observations it was found that these plants were especially attacked by a form of rust (*Melampsora lini*). So severe was the rust that in some instances the flax plants were almost completely destroyed. It has already been observed that some sorts of flax are more resistant to rust than others, and in the future investigations will be carried on for immunity both to rust and wilt.

Some notes are given on potatoes, and the variation of some varieties and of individual plants in resisting disease is pointed out.

A brief account is given of the use of commercial cultures in inoculating legumes, and in the experiments no distinction could be drawn between the treated and the untreated plats.

The tree-feeding experiments, which have been described in previous reports (E. S. R., 16, p. 131; 17, p. 261), were discontinued in 1905 on account of other work, but some observations made showed that the native plum trees which had been treated for the prevention of plum pockets were less attacked than untreated trees in the immediate vicinity. Trees treated for apple blight in 1904 remained healthy during 1905 and produced fruit.

Further observations on the germination of the seeds of the castor-oil plant, J. R. Green and H. Jackson (*Proc. Roy. Soc. [London], Ser. B, 77 (1905), No. B 514, pp. 69–85*).—The results of a series of investigations extending back about 15 years in which the authors endeavored to ascertain the course of the decomposition and utilization of the reserve materials in the seed of the castor-oil plant during germination are given.

Various conclusions are drawn from earlier experiments, which are modified somewhat, and the authors state that the germination of the seed of castor bean is associated with a remarkable activity of the cells of the endosperm, which set up a very complex metabolism. The protoplasm takes a prominent part in the metabolic changes produced, secreting enzyms, and causing various chemical changes in the cells. In this renewed activity the embryo contributes to enzym formation, and the result is the production of a great variety of nutritive material, part of which is the direct product of enzym action and part is due to the secretory activity of the protoplasm as well as to the interaction of the products of both these agents. Two varieties of sugar, lecithin, fatty acids and the products of their oxidation, proteids and the products of their digestion, including various nitrogenous bodies, amino-compounds, and amido-compounds are present. Analyses of the cotyledons showed them to contain varying quantities of lecithin, in some cases amounting to 1.36 per cent of their dry weight. Both sugars may be detected in the cotyledons, the relative amounts varying, but cane sugar being usually present in the largest quantity.

The reaction of the cell sap is acid, showing traces of phosphoric acid mixed with an organic acid whose nature has not yet been ascertained. It is probable that in the transportation of the nutritive substances to the embryo the protoplasmic threads in the cell walls play an important part, and dialysis undoubtedly plays a large part in the absorptive processes, especially where crystalline substances are concerned.

On stimulants of nutrition in plants, H. MICHEELS (*Rev. Sci.* [*Paris*], *5. ser., 5* (*1906*), *No. 14, pp. 427–429*).—Experiments on the influence of solutions of colloidal tin on the germination and early growth of wheat, oats, peas, buckwheat, etc., are reported, showing that this substance has a very marked influence in promoting germination and growth. It apparently acts upon the reserve material of the seed in much the same manner as diastase or other ferments.

On the nature of the galvanotropic irritability of roots, A. J. EWART and JESSIE S. BAYLISS (*Proc. Roy. Soc.* [*London*], *Ser. B, 77* (*1905*), *No. B 514, pp. 63–66*).—The authors review and attempt to explain the contradictory statements of a number of investigators on the nature of the galvanotropic irritability of roots, after which they briefly describe some experiments which tend to show that the galvanotropism of roots is due to chemotropic stimulation by the products of electrolysis, of which the acid is more effective than the alkali. It is claimed that in Brunchhorst's experiments, which seem to show that strong currents produced a curvature toward the positive electrode and weak ones toward the negative electrode, the electrolysis probably occurred in the superficial cells of the roots submerged in water, the tissues being sufficiently impermeable to the liberated acid and alkaline ions to allow them to accumulate beyond the minimum for stimulation. Although the curvature is usually sharp and strongly localized to the point of application of the electrode, the indications are that the response is a stimulatory one and is not due to the direct action of the products of electrolysis, retarding growth on one side or accelerating it on the other.

The action of certain organic substances on the form and structure of leaves, M. MOLLIARD (*Bul. Soc. Bot. France, 53* (*1906*), *No. 1, pp. 61–65*).—Experiments are reported that were conducted to determine the relation which exists between the structure of some of the higher plants and the organic medium in which they were grown. All the experiments were with radishes, one lot being grown in mineral solutions, the others in various forms of carbohydrates. The growth in the mineral solutions was comparable with that of plants grown under normal conditions, but when grown in solutions of saccharose, glucose, levulose, dextrin, etc., the morphological structures showed marked departures

from normal. The color, size, form, and structure of the leaves were greatly modified by the different carbohydrates, and in some cases the changes were in proportion to the strength of the solutions. Saccharose intensified the coloration, reduced the size of the leaves, and modified their contour. Glucose reduced the size of the leaves, their margins were more deeply dentated, and very important changes were noted in their structure, especially in the palisade tissues. Mannite and glycerin modified the leaves so greatly as to indicate an injurious action.

The growth of chlorophyll bearing plants in amids in the absence of carbon dioxid, J. Lefèvre (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), Nos. 3, pp. 211–213; 17, pp. 664, 665; 24, pp. 1035, 1036*).—An account is given of experiments with common garden cress, nasturtiums, and sweet basil grown in artificial soils to which various media were added, but with the entire exclusion of carbon dioxid. The seedlings were placed in pots filled with crushed silica that had been washed with acid and incinerated, sterilized artificial moss being mixed with it to give proper consistency. To each 350 gm. of the artificial soil there were added 0.1 gm. each of tyrosin, oxamid, and leucin, and 0.4 gm. of glycocoll and alanin. The plants were placed under bell jars and kept free from carbon dioxid by passing all air through Schloesing baryta tubes. Numerous check pots were maintained, and the results in all cases were analogous.

It was found under the conditions of the experiments that the plants grew in the absence of carbon dioxid, increasing their height 5 to 10 times, with a corresponding increase in the number of leaves. When both carbon dioxid and amids were excluded, no growth resulted and the plants speedily died. It is claimed that the growth was due to actual nutrition of the plants and not to artificial hydration.

The results show that in the light, green plants are able to carry on synthesis in the presence of amids and in the exclusion of carbon dioxid. This synthesis is held to be a function of chlorophyll.

On the water relations of the cocoanut palm, E. B. Copeland (*Philippine Jour. Sci., 1 (1906), No. 1, pp. 6–57, pls. 3*).—An investigation was inaugurated to determine, through a study of the physiology of the cocoanut palm, results that would be available for improving existing methods of the cultivation of the plant. The investigations are reported upon in the following order: The root, its structure and growth, and the absorption of water; the leaf, its structure, the activity of the stomata, and transpiration; with final conclusions as to the fitness of the plant for its characteristic habitat and suggestions as to its most advantageous cultivation.

Among the practical conclusions, the author states that a considerable supply of water must constantly be at the disposal of the tree, or it will protect itself against injurious desiccation by a partial suspense of its vitality. The quantity of mineral food which the tree takes is roughly proportional to the amount of water which it absorbs, and by increasing the plant's transpiration the same results are obtained as would follow the application of fertilizers to the ground. The amount of transpiration can be increased either by increasing the amount of water at the disposal of the roots or by improving the conditions for its evaporation from the leaves. The transpiration of the cocoanut is accelerated by the action of the wind, and to a still greater extent by increase of illumination. In planting the trees the author doubts whether any increase beyond 15 meters' distance between trees would be advantageous. In his opinion, under ordinary conditions trees in a grove usually do best when placed at intervals of about 9 meters. In order to secure increased yield, the author suggests better cultural methods and improvement through the selection of the seed used in planting.

FIELD CROPS.

Results of cooperative experiments in agriculture, C. A. Zavitz (*Ann. Rpt. Ontario Agr. and Expt. Union, 27 (1905), pp. 12-33*).—A description of these experiments is given in connection with previously reported results (E. S. R., 17, p. 351). In the cooperative experiments in the season of 1905 the leading varieties of grain crops gave the following average yields per acre: Joanette oats, 120 tests, 53.58 bu.; Mandscheuri Six-rowed barley, 28 tests, 37.73 bu.; Black Hulless barley, 13 tests, 24.63 bu.; Wild Goose spring wheat, 24 tests, 34.87 bu.; Common emmer, 19 tests, 39.94 bu.; Red spelt as compared with emmer, 31.90 bu.; Japanese buckwheat, 7 tests, 37.50 bu.; Early Britain field peas, 19 tests, 28.32 bu.; New Prize Winner field beans, 20 tests, 27.21 bu.; Early Yellow soy beans, 2 tests, 18.33 bu.; Dawson Golden Chaff winter wheat, 14 tests, 23.16 bu.; and Compton Early corn, 17 tests, 56.74 bu. The best and most popular mixture of grains consisted of 34 lbs. of Daubeney oats and 48 lbs. of Mandscheuri barley, which produced on the average in 11 tests 2,073 lbs. of grain per acre. In all cases except one the varieties here mentioned ranked first in popularity with the experimenters. Joanette oats stood second in this regard.

The leading varieties of field roots and fodder crops gave the following yields per acre: Yellow Leviathan mangels, 8 tests, 33.57 tons; Giant White Feeding sugar beets, 7 tests, 35.65 tons; Sutton Magnum Bonum swede, 2 tests, 18.04 tons; Red Top White Globe fall turnips, 2 tests, 34.53 tons; Mastodon White Intermediate carrots, 8 tests, 24.56 tons; Henderson Eureka fodder corn, 7 tests, 17.48 tons; Japanese Panicle millet, 2 tests, 16.72 tons, and Dwarf Essex rape, 1 test, 17.82 tons. In 3 tests grass peas, common vetches, and hairy vetches gave 10, 8.93, and 8.65 tons per acre, respectively. Nearly all these varieties were the most popular with the experimenters, excepting Henderson Eureka fodder corn, which was outranked by White Cap Yellow Dent, and grass peas, which ranked next to the vetches.

Three varieties of sweet corn, Ringleader, Mammoth White Cory, and Golden Bantam, requiring 84, 87, and 88 days, respectively, to mature for table use, were grown in 21 tests. In comparative value Ringleader stood first and in table quality Golden Bantam. The average results for 6 years in 38 tests show that corn in hills gave an average of 11 tons of whole crop as compared with 10.16 tons for corn planted in drills.

In the fertilizer experiments conducted as in previous years, the greatest yield of total crop of corn was secured from the use of muriate of potash and the greatest yield of husked ears from the complete fertilizer. An application of 160 lbs. of muriate of potash per acre increased the yield 1.5 tons at a cost of about $3 per ton for the fertilizer used. The best yield of swedes, 23.1 tons per acre, was secured where barnyard manure was applied. In 41 tests during 5 years the best average yield of mangels, 26.5 tons per acre, was obtained with nitrate of soda, and during this same period in 74 experiments the highest average yield of oats, 48.7 bu. per acre, was secured with the complete fertilizer.

In 1905 the average yields of 3 late varieties of potatoes, Dempsey Seedling, Empire State, and American Wonder, grown in 93 tests, were, respectively, 177.1, 160.3, and 159.4 bu. per acre. Of 2 medium varieties grown in 70 tests, Rose of the North stood first with 184 bu. per acre, while among early varieties in 158 tests Early Fortune headed the list with 167.4 bu. Dempsey Seedling, Rose of the North, and Early Fortune ranked first in popularity in their respective classes. The average results of 33 tests for 5 years show a slight advantage in growing potatoes on ridges as compared with growing them on the level.

The Woburn field experiments, 1904, J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 66 (1905), pp. 192–205*).—Earlier results have been previously noted (E. S. R., 17, p. 543). In the continuous wheat-growing experiments the largest yield this year, 17.1 bu. per acre, was secured from the plat receiving in alternate years, including 1904, 3½ cwt. of superphosphate of lime, 200 lbs. of sulphate of potash, 100 lbs. each of sulphate of soda and sulphate of magnesia, with nitrate of soda sufficient to furnish the quantity of nitrogen contained in 100 lbs. of ammonia per acre. The injurious effect of the continued use of ammonia salts and nitrate of soda was strongly shown this year with a rainfall of only 22 in. The effect of 2 tons of lime applied in December, 1897, was still noticeable this season. Where nitrate of soda was omitted for a single year the yield fell below that of the unmanured plat. In quality of grain the barnyard manure plat ranked with the best, while the nitrate of soda plat stood last.

The highest yield of barley, 37 bu. per acre, was secured with a heavy dressing of nitrate of soda and minerals. As with wheat, the continued use of ammonia salts showed its injurious effects, while lime proved beneficial. In the green manuring experiment mustard plowed in with mineral manures gave better results with both quantity and quality of barley than tares used in the same way.

Of 2 Canadian wheats compared Red Fife yielded 20.2 bu. and Preston 12.6 bu. per acre. Both varieties produced grain of high quality.

The use of 4 cwt. each of superphosphate, bone dust, and sulphate of potash, and 2 cwt. of sulphate of ammonia per acre for alfalfa gave a yield of more than 9½ tons of hay. Where 2 cwt. of nitrate of soda was substituted for sulphate of ammonia the yield was a little over 8.3 tons, while single applications of these substances gave in all cases less than 4 tons per acre.

English common sainfoin proved more satisfactory than English Giant, and both gave much heavier yields than the French Giant and common varieties. Sulphate of potash gave better results as a fertilizer for potatoes than kainit.

In the finger-and-toe experiments on swedes 2 tons of carbolized lime per acre was the only application which produced no unsound roots.

The Woburn pot-culture experiments, 1904, J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 66 (1905), pp. 205–211*).—A report on the Hills experiments is given. The results of this year indicate that the use of solutions of sulphate of manganese and sulphate of iron not over 2 per cent in strength, improves the germination of seed grain. Soaking wheat in solutions of sulphate of manganese gave no appreciable increase in grain and straw, while soaking in a 2 per cent or 5 per cent solution of sulphate of iron produced a gain in total yield. It is concluded that solutions of sulphate of manganese up to 2 cwt. per acre, applied directly to the growing plant, increased the yield and that sulphate of iron used at the rate of one-half or 1 cwt. per acre has a similar effect. Silicates of potash and soda did not improve germination, but when given at least at the rate of 4 cwt. per acre were beneficial, especially in improving the yield of straw.

The germination of barley was not injured by soaking in these solutions. The use of a solution of sulphate of manganese up to a strength of 5 per cent was of some benefit, while soaking in a solution of sulphate of iron did not injure germination, but was not productive of any improvement. These solutions applied directly to the growing plant produced some increase of crop. Silicates of potash and soda benefited the crop, especially the straw.

[Report on the] subsection of agronomy, W. H. OLIN (*Colorado Sta. Rpt. 1905, pp. 24–36*).—The work of the season consists of field nursery work, testing of grains and forage plants, cooperative field work, and sugar-beet investiga-

tions. Of 9 varieties of barley grown Hanchion and U. S. No. 12023, both 2-rowed varieties, headed the list in yield with 59.6 and 53.4 bu. per acre, respectively. The barleys were grown on alfalfa sod, which encouraged a rank growth and a tendency to lodge. Of 16 varieties of wheat Colorado No. 45 and Colorado No. 50 were the earliest, ripening the first week in August. Minnesota No. 169 ripened last. The grain of this variety was only in the milk when the grain of the two varieties mentioned above was in the dough stage. Kubanka sown in April and May was not seriously injured by rust, but Defiance, sown at the same time, suffered from this disease and lodged very badly before it was fully ripe. Sonora was more severely attacked by rust than any other variety. The results of seedings made at intervals of about 1 month from January to June seemed to indicate that the earlier seedings are the more satisfactory. In connection with milling wheat investigations it was found that, in the opinion of the millers, Defiance is the best spring wheat and Turkey Red the best winter wheat for milling purposes. Baking tests by over 40 experienced bread makers of Fort Collins showed that the flour of durum wheat produces bread of an excellent flavor and of good texture and volume.

Among 10 varieties of oats Early Champion and U. S. No. 12303 ripened earliest and produced the finest straw. The most productive varieties were White Russian, Kansas No. 2, and Colorado No. 13, yielding 93.1, 92.8, and 92.4 bu. per acre, respectively. Colorado No. 5, the heaviest variety, produced grain weighing 47 lbs. per bushel.

Cooperative field work with farmers in different sections of the State and the sugar-beet investigation work conducted by the station are briefly noted.

Report of the agriculturist, J. J. VERNON (*New Mexico Sta. Rpt. 1904, pp. 24–27*).—A brief description of the work of the department with field crops is given and some of the results are reported. Twenty-four varieties of wheat were tested, the yields ranging from 57.5 bu. per acre for Rodi to 15.8 bu. for Ruby. Ruby also stood last in the yield of straw with 1,486.8 lbs. per acre, while Defiance stood first with 7,973 lbs.

For the purpose of determining the best means of incorporating humus in the soil 1 plat received a heavy coating of stable manure, 1 was sown to cowpeas, and 1 to hairy vetch. These were compared with a spring-plowed plat and a check plat which were cropped as usual. The cowpeas and the hairy vetch had made a very rank growth when they were plowed under. The largest yield of corn stover was secured on the cowpea plat, the largest yield of barley straw on the manure plat, of oat straw on the hairy vetch plat, and of wheat straw on the cowpea plat. In grain production the manure plat stood first in the yield of corn and barley, while the hairy vetch plat ranked first in the yield of oats and the spring-plowed plat in the yield of wheat.

[Report on field crops], J. H. SHEPPARD (*North Dakota Sta. Rpt. 1905, pp. 33–46, pls. 5*).—A general outline of the work during the year is given, together with more detailed notes on the plant-breeding work and the results of experiments with red clover and alfalfa.

Twenty samples of red clover from different States and countries are under test in a cooperative experiment with this Department. The yield of cured hay ranged from 1.87 to slightly more than 3 tons per acre. The clover was sown with fife wheat as a nurse crop in the spring of 1904. On August 2 after the wheat had been mown for hay the seed from Missouri, eastern Ohio, and Russia showed the best stand and most thrifty appearance, with the seed from Illinois and Wisconsin about as good. October 5 the seed from Illinois and Wisconsin had the best general appearance. The second growth was ready for cutting about September 10, 1905, and the yields secured during the year are regarded as positive evidence that with proper treatment red clover can be

successfully grown in the Red River Valley. At the time of the second cutting one-half of each plat was left to produce seed. The highest yield secured was 2 bu. 26 lbs. It was observed during this season that a clover seeding made in the spring with wheat as a nurse crop did not suffer as much from heavy rains as alfalfa.

Alfalfa sown in 1901 and 1902 after 3 and 4 winter seasons still makes vigorous growth. On June 27 of this year, when the first crop was cut, the Turkestan variety was 36 in. high and formed 90 per cent of a stand, giving a yield of 2.37 tons per acre. The second growth, which was as heavy as the first, was allowed to ripen seed. Grimm alfalfa as compared with Turkestan had finer stems and produced more branches and leaves. The first cutting of Grimm alfalfa gave a yield of 3.24 tons per acre.

Forage crops, 1905, G. A. Billings (*New Jersey Stas. Rpt. 1905, pp. 349–376, pls. 10*).—The summer system of soiling was continued as in previous years (E. S. R., 17, p. 353). With the exception of two weeks in July, summer forage crops were fed to the station herd from May 1 to October 15, a period of 153 days. The average cost of production was $1.93 per ton and the average yield on 16 acres 12.3 tons per acre.

In this connection a series of forage crop rotations was studied. This included 1 plat of corn for silage, 1 plat of wheat and winter vetch for the first crop and white flint corn for the second crop, and 1 plat of alfalfa for hay. A plat of oats and vetch and 1 of millet suffered from dry weather, while oats and peas began to mature when the dry weather set in and produced an average yield. Five plats gave an average yield of 14.8 tons of forage per acre, while 3 gave an average yield of only 7.3 tons. Excellent results were secured on the plat on which wheat and winter vetch were followed by corn. The wheat and winter vetch produced 7.10 tons of forage per acre and the flint corn 108.7 bu. of ears and 5.6 tons of dry fodder. It is stated, however, that the high price of vetch seed makes its profitable use doubtful. General notes on rye, wheat, winter vetch, crimson clover, and alfalfa are given.

Inoculation experiments were made, but weather conditions interfered with the accuracy of the results. The inoculating material consisted of 450 lbs. of soil from an old alfalfa field and the same quantity from a field of sweet clover. The plats so treated were compared with a plat receiving no inoculation and one inoculated the previous year. Before inoculation the land received 200 lbs. of oyster-shell lime and about 300 lbs. of fertilizer per acre. The examination of the roots on all plats showed the nodules equally abundant. They were most numerous where the soil was deep and the foliage green and thrifty. On yellow spots with less thrifty plants the nodules were found in more compact masses than where the plants were green. An examination by the station bacteriologist showed that these masses also contained more of the branched forms of bacteria, which are usually found on healthy, vigorous plants, but in this case seemed so abundant on the sickly ones. This condition was not due to lack of nitrogen, as an application of nitrate of soda at the rate of 100 lbs. per acre showed no beneficial effect. This clustering of the nodules is considered as possibly due to the ventilation of the soil or its porosity, soil acidity, or different bacteria entering in to influence the form of the nodules. The results secured do not admit of giving definite conclusions, but it is suggested that some time previous to seeding organic matter be incorporated into the soil by a liberal application of barnyard manure or green manuring, and that an application of at least 2,000 lbs. of stone lime be given at the time of seeding, or preferably, 2,000 lbs. a year or two before seeding and 1,200 lbs. at the time the seed is sown.

Cylinder experiments were made with lime for alfalfa on different types of soil. These soils were benefited by the lime in the following order: Augusta limestone, Freehold marl, New Brunswick red shale, Oakland glacial drift, Woodstown heavy clay, and Woodbine sand. In another test it was shown that nitrate of soda applied in June, July, and August did not increase the yield. In this test the use of 300 lbs. of acid phosphate and 200 lbs. of muriate of potash gave an increased yield of only 4.1 per cent over the use of 200 lbs. of acid phosphate and 150 lbs. of muriate of potash.

Thoroughbred white flint corn planted July 19 yielded 8.25 tons of green forage per acre, and a mixture of 12 qts. of Kafir corn and 1¼ bu. of cowpeas, sown broadcast, per acre, gave a yield of 11.3 tons. Twelve varieties of cowpeas were compared and notes on the habit of growth and the yields are given. Clay ranked first in the production of green forage, with 8.3 tons per acre, and Warren New Hybrid in the production of seed, with 13.3 bu. In a test of 4 varieties of soy beans Medium Yellow No. 12399 stood first in production of both green forage and seed, the yields being 6.9 tons and 24.5 bu., respectively. The average cost of producing a ton of hay from 10 acres of oats and peas was $7.91, the average yield per acre being 2.15 tons. Four varieties of corn grown for the silo produced a ton of forage at an average cost of $1.14, the range being from $1.10 to $1.19. Southern White stood first in yield, with 9.7 tons per acre. A comparison of soiling and silage crops showed that corn silage cost per ton 18 cts. more than soiling crops.

Nitrate of soda proved profitable when applied as a top-dressing to rye, but on wheat and vetch it was used at a loss. It is stated that this substance should be applied only on cereals and grasses very early in the spring.

Observations and experiments on clover, alfalfa, and soy beans, H. GARMAN (*Kentucky Sta. Bul. 125, pp. 37–61, pl. 1, fig. 1*).—Soil inoculation for leguminous crops is discussed and results obtained in experiments along this line are reported. The failures in growing leguminous plants are considered due to poor seed, insufficient humus content of the soil, inadequate soil preparation, weeds, plant diseases and insect enemies, and the absence of lime, potash, or other mineral elements. The results of investigation with these different crops indicate that clover should be grown on clean land containing some humus and alfalfa on good land not too wet. Both crops give best results from spring planting on well-prepared land, the seed being worked in with a drag or harrow. Inoculation with cultures or soil did not help the stand of either clover or alfalfa, and nodules are developed on both plants in Kentucky soils without inoculation, although this treatment may increase the number of nodules in any soil. Inoculation of the seed failed to increase the yield of the leguminous plants, but it is believed that the benefit from inoculation in these particular soils falls largely to the succeeding crop. It was observed that the nodules were large when few and small when numerous, and that fresh moist cultures are better than dry ones.

Culture tests in 1904 and 1905, A. DAMSEAUX (*Bul. Agr. [Brussels], 22 (1906), No. 1, pp. 54–61*).—Experiments were made with cereals, root crops, and various other forage plants. The results of fertilizer experiments with sugar beets, in which 300 and 500 kg. of salt was applied in conjunction with 500 kg. each of superphosphate and nitrate of soda per hectare, showed that the use of the salt increased the yield of sugar. The largest yield of roots and leaves of carrots was obtained on a plat where 20,000 kg. of barnyard manure, 500 kg. of superphosphate, and 200 kg. each of sulphate of potash and nitrate of soda were applied per hectare. This plat produced 72,100 kg. of roots and 12,500 kg. of leaves, furnishing 8,940 kg. of dry matter per hectare.

The manurial value of different potassium compounds for barley and rice, K. Aso (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 67–72*).—It was found that potassium chlorid accelerated the flowering process and augmented grain production in barley, while it reduced the yield of rice. The fertilizer value of the silicate was highest in several cases and martellin is regarded as a good potash fertilizer for grasses. The chlorid acted very favorably on the production of grains, while the sulphate tended to increase the formation of straw. The carbonate was inferior to the sulphate in all cases when applied with secondary sodium phosphate, a physiologically alkaline manure.

On the influence of the reaction of the manure upon the yield, K. Aso and R. Bahadur (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 39–46, pl. 1*).—Different combinations of plant food substances were used in sand with rice, peas, and barley, and soil culture with onions and barley. The influence of the reaction of the manuring compounds was observed to be very great. The combination of ammonium sulphate and disodium phosphate produced the best results with paddy rice, while the mixture of sodium nitrate and monosodium phosphate gave the best results with barley and peas. In the test with onions ammonium sulphate produced a much better result than sodium phosphate when phosphoric acid was given as disodium phosphate and potash in the form of potassium carbonate.

On the lime factor for flax and spinach, S. Namikawa (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 57–60*).—The lime factor is here determined as the best ratio of lime to magnesia, and the results secured show that this factor for flax and spinach is about equal to 1.

Plowing experiments, W. Farrer and G. L. Sutton (*Agr. Gaz. N. S. Wales, 17 (1906), No. 4, pp. 319–326, fig. 1, dgms. 2*).—In connection with experiments with wheat at the Cowra Experiment Station a comparison of disk and mold-board plows for preparing the soil showed that in new ground of a loamy character and during a wet fall and winter the use of the mold-board plow is preferable to the disk plow. The results obtained further indicate that it is much better to plow 6 in. deep with the mold-board plow than to plow only 4 in. deep; and when the work is done with the disk plow a depth of 8 in. seemed to give better results than shallower plowing.

Alfalfa, W. P. Headden (*Colorado Sta. Bul. 110, pp. 16*).—This bulletin is a general and brief treatise on the culture of alfalfa in Colorado, the discussion being based largely on the subject-matter contained in Bulletin 35 of the station (E. S. R., 8, p. 768). Since the publication of that bulletin vitality and germination tests of alfalfa seed were made and the results are here briefly stated. It was determined that the first quality seed purchased in 1905 by the station contained 288,267 seeds per pound, while 2 samples of first quality screenings contained 259,340 and 266,233 per pound, respectively. Twelve samples of seed and screenings were kept for a series of years, the age of the samples in 1906 varying from 2 to 16 years, 11 of the samples being over 11 years old. The average percentage of germination in these samples ranged from 14 to 92.5. The sample averaging highest was 12 years old and had lost during this period only 2.5 per cent of its germinating power. Four other tests were made with this sample and the average of these 4 tests showed a germination of 94.25 per cent, or very nearly as high as in the test made in 1896 when the seed was only 2 years old. The results with this sample show that "good, plump, mature, clean alfalfa seed does not lose its vitality rapidly when kept with ordinary precaution to prevent injury from moisture." The oldest sample had a germinating power of 93 per cent when 6 years old, of 72 when 10 years old, and of 63 when 16 years old. The author believes that the limit for the

vitality of good, mature alfalfa seed exceeds 16 years. The variation between different lots of seed is shown in this test by the sample which was only 2 years old and had a germinating power of but 67.5 per cent. The seeds in this sample were small.

Alfalfa, W. P. Headden (*Colorado Sta. Bul. 111, pp. 12*).—A synopsis of Bulletin 35 of the station (E. S. R., 8, p. 768).

The alfalfa seed crop and seeding alfalfa, A. M. Ten Eyck (*Kansas Sta. Bul. 134, pp. 111–131*).—This bulletin presents the experience in saving alfalfa for seed as described by several hundred prominent alfalfa growers throughout the West, but mainly in Kansas. In this way complete directions are given for growing alfalfa for seed and also for seeding the crop and obtaining a good stand.

Alfilaria (Erodium cicutarium) as a forage plant in Arizona, J. J. Thornber (*Arizona Sta. Bul. 52, pp. 23–58, figs. 5, map 1*).—The introduction and dissemination of alfilaria in Arizona is discussed, the botanical characters of the plant described, and the factors favoring its growth in the Southwest are pointed out. Chemical analyses of two samples by A. E. Vinson, of the station, resulted in the following data for alfilaria in seed: Moisture content 81.53 per cent, ash 3.52, protein 2.38, crude fiber 4.46, nitrogen-free extract 7.82, and ether extract 0.39. Good alfilaria hay contained 8.88 per cent of moisture, 13.30 per cent of ash, 13.49 per cent of protein, 20.55 per cent of crude fiber, 41.58 per cent of nitrogen-free extract, and 2.20 per cent of ether extract. Directions for collecting and sowing the seed are presented. It is shown that sheep have been very instrumental in spreading the plant.

On the formation of anthokyan in the stalk of barley, S. Suzuki (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 29–37*).—The author observed in pot experiments that the red coloration shown in stalks of certain barley plants was due to anthokyan. Plants manured differently produced good stalks of a normal green color. Experiments were made on a sandy soil of great natural fertility and on a loam of poor fertility. Different combinations of fertilizers were applied. The data secured led to the conclusion that formation of anthokyan in the stalks is a sign of deficiency in the soil of available phosphoric acid or nitrogen, or of both these elements.

The influence of distance between plants on the quantity and quality of fodder beets, G. Frölich (*Fühling's Landw. Ztg., 55 (1906), No. 8, pp. 264–269*).—Distance experiments were conducted for several years with fodder beets and the results indicated quite clearly that narrow planting produced not only a larger quantity of beets and an increase in food material, but also favored the production of healthier and better-formed beets with improved keeping qualities. The author recommends planting the Friedrichswerth fodder beet in rows 14 in. apart, leaving the plants at intervals of 9 in. in the row.

Clovers and how to grow them, T. Shaw (*New York: Orange Judd Co., 1906, pp. 349, pl. 1, figs. 11*).—A general description of the clover plant is given and popular directions for the growing of clovers are presented. An entire chapter is devoted to each of the more important varieties and species. In this list are included medium red, alsike, Mammoth, crimson, white, Japan, burr and sweet clovers, and alfalfa. A number of miscellaneous varieties of lesser importance, including sainfoin, Egyptian clover, yellow clover, sand lucern, Japanese clover, and beggar weed are briefly noted.

Cotton industry in the Leeward Islands, F. Watts (*West Indian Bul., 7 (1906), No. 1, pp. 30–35*).—The growth of the cotton industry in the islands since 1900, when the present movement was begun by planting a small plat at the Antigua Experiment Station, is described. In 1904, 3,560 acres, and in 1905

approximately 5,000 acres were grown. The results of fertilizer experiments show that commercial fertilizers are not yet necessary in cotton culture, and the author advises that the cotton seed be fed to stock and the land enriched by the use of the manure.

Report on manuring of hay, 1906, R. B. GREIG (*Aberdeen and No. of Scot. Col. Agr. Bul. 5, pp. 13, dgms. 2*).—Results of cooperative fertilizer experiments in 1904 and 1905 are tabulated and briefly noted. It was shown that a complete fertilizer of nitrate of soda, superphosphate, and sulphate of potash given at the rate of about 4 cwt. per acre produced the largest crop and the largest profit in one application. Nitrogen was found essential and potash more necessary than phosphates. Superphosphate and basic slag were more useful than bone meal and ground Florida phosphates in the first year's application. Sulphate of potash and all the phosphatic manures showed considerable residual value.

Cultural methods for sugar beets, W. H. OLIN (*Colorado Sta. Bul. 109, pp. 12, figs. 3*).—This bulletin points out the progress made in the culture of sugar beets in the State and records the methods practiced by the most successful sugar-beet growers, as shown by question circulars sent to 1,000 farmers distributed over 3 beet-growing regions of Colorado. From the answers received it was found that 54 per cent of the growers practiced spring plowing, that usually early planting is best for yield and quality, and that nearly all those reporting used from 15 to 20 lbs. of seed per acre. The average space between the plants in the rows is 10.4 in., and the best average results were secured where the crop was cultivated 3 times. The average tonnage for 1904 is given as 17.4 tons, and for 1905 as 14.25 tons per acre. The average expense per acre is estimated at $33.05. Various other brief statements regarding the culture of this crop are also given.

Progress of the beet-sugar industry in the United States in 1905, C. F. SAYLOR (*U. S. Dept. Agr. Rpt. 82, pp. 130, figs. 5*).—A general review of the beet-sugar industry for the year is given and discussions on the conditions favorable to the establishment of the industry, the culture of the sugar beet, climatic conditions, and farm and factory results, together with the probable future of the industry in this country by States are presented. Statistics of the sugar industry in the United States and the world at large are also given. Sugar-beet investigations in 1905 by the Bureau of Plant Industry of this Department are briefly described.

The total number of factories operating in 1905 was 52. Four were idle during the year, and in March, 1906, 12 factories were in building. A tabulated summary of the results for 1905 shows that a total of 307,364 acres of beets averaging a yield of 8.67 tons per acre were harvested. The total quantity of beets worked was 2,665,913 tons, producing 312,920.60 tons of sugar. The average sugar content of the beets was 15.33 per cent, the average purity coefficient 82.96, the average length of the campaign 76.6 days, and the estimated average extraction of sugar 11.74 per cent.

Reports from agriculturists at sugar factories show briefly how irrigation was practiced in connection with beet growing, and reports from State experiment stations summarize the recent experimental work carried on by these institutions.

The work in growing single-germ beet seed has reached a point where strains have been secured producing approximately 25 per cent of single-germ seed.

It is reported that during the year blight or leaf spot in the Eastern States and curly top in the Rocky Mountain and Pacific Coast areas did serious damage. It has been shown that the blight may be prevented by spraying with Bordeaux mixture. No definite cause for the curly top has as yet been worked

out. It was observed that this disease rarely occurs twice in the same place consecutively. The work in growing sugar-beet seed is described and the results secured in 1904, which are the latest complete returns at hand, are again given. Earlier work in this line has been previously noted (E. S. R., 17, p. 29).

The sugar industry of Natal, A. N. Pearson and A. Pardy (*Natal: Dept. Agr. [1906], pp. 16, figs. 2*).—Historical notes on the sugar industry are given and its present position and prospects are described. Statistics of imports and exports of sugar and of the production in Natal, and the total consumption in South Africa are presented. The varieties of cane generally grown are enumerated and briefly noted and analyses of different canes are reported.

Report on the experimental work of the sugar experiment station for the year 1905, H. H. Cousins (*Rpt. Jamaica Sugar Expt. Sta., 1905, pp. 140*).—Fertilizer, varietal, selection, and distillery experiments are reported. In the variety tests a yield of nearly 50 tons per acre was secured on 2 acres of seedling B 208. In the selection tests this variety also showed the most merit, giving a tonnage of 65.5 tons of canes per acre. Other varieties worthy of some attention as shown by results secured at Hope are D 1429, B 316, D 109, and D 95. Among Jamaica seedling canes resulting from naturally cross-fertilized seed grown in 1903, No. 30 gave an indicated yield of 74.4 tons per acre, equal to 20.955 tons of sucrose, and No. 22 gave a very rich juice containing 2.2 lbs. of sucrose per gallon.

The bulletin includes a report by C. Allan, fermentation chemist, on the manufacture of Jamaica rum.

Manurial experiments with sugar cane in the Leeward Islands, 1904–5, F. Watts et al. (*Imp. Dept. Agr. West Indies, Pamphlet 42, 1906, pp. 47, dgms. 4*).—As in former years, the results with plant canes were unfavorable to the use of commercial fertilizers, but with the rattoon crop the use of sulphate of ammonia and nitrate of soda was of benefit. The details of these experiments have been previously given (E. S. R., 17, p. 460).

Tobacco breeding experiments in Connecticut, A. D. Shamel (*Connecticut State Sta. Rpt. 1905, pt. 6, pp. 331–342, pls. 3, fig. 1*).—A general outline of the breeding work carried on by the station in cooperation with this Department is given and two new varieties produced by hybridization, known as the Cooley hybrid and the Brewer hybrid, are described in detail. The Cooley hybrid was obtained by crossing Havana seed with pollen from plants grown from Florida Sumatra tobacco seed, and the Brewer hybrid by crossing Connecticut Broadleaf tobacco with Cuban as the male parent.

Methods of testing the burning quality of cigar tobacco, W. W. Garner (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 100, pt. 4, pp. 14, pls. 2, figs. 3*).—Complete descriptions are given of the methods of testing the burning quality of cigar tobacco by means of different kinds of apparatus. The general results obtained indicated that in order to secure a good burn a heavy filler should be wrapped with a comparatively heavy wrapper and a light-bodied filler with a light-bodied wrapper, and that of the three components the filler exerts the strongest influence on the evenness of the burn. It was also shown that the wrapper and binder strongly influence the character of the ash and that the binder very materially affects the ash of the wrapper.

Garlicky wheat, J. W. T. Duvel (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 100, pt. 3, pp. 14, pls. 2*).—Experiments are reported in which garlic was removed from 3 lots of wheat by drying the samples artificially and then removing the garlic bulblets by means of cleaning machinery. The quantity of garlic by weight in the 3 lots, A, B, and C, was 2.17, 0.56, and 2.04 per cent, and the

average loss in weight due to the removal of garlic was 2.12, 0.50, and 1.88 per cent, respectively. Other results secured are shown in the following table:

Results in experimental drying and cleaning of garlicky wheat.

Sample mark.	Duration of drying.	Temperature of air current in drying.	Maximum temperature of wheat.	Water content of wheat.	Germination.
Lot A:	*Hours.*	*Degrees F.*	*Degrees F.*	*Per ct.*	*Per ct.*
Original sample	....	....	....	16.55	....
Experiment No. 1	2½	....	136	8.94	....
Experiment No. 2	4	....	140	5.87	....
Lot B:					
Original sample	....	....	....	15.08	80
Experiment No. 3	3	153–158	155	7.92	83.5
Experiment No. 4	3½	153–158	145	6.88	85
Experiment No. 5	2¾	155–108	138	8.48	79.5
Lot C:					
Original sample	....	....	....	16.20	82
Experiment No. 6	2½	113–154	149	8.20	83
Experiment No. 7	3	146–122	131	8.83	85

Lot A was increased in value by 17 cts. per bushel, equivalent to 28.6 per cent; Lot B by 30 cts., or an increase in its value of 54.5 per cent; and Lot C by 24.5 cts., or 40.8 per cent. In none of the experiments was all the garlic removed, but its quantity was reduced considerably more than was necessary to make the wheat grade as No. 2 Red. The cost of removing the garlic was 5½, 2¾, and 4¾ cts. per bushel for Lots A, B, and C, respectively, as governed by the prices current at the time.

The origin of Rietti wheat, E. A. Nobbs (*Agr. Jour. Cape Good Hope, 28 (1906), No. 5, pp. 675–677*).—The history of Rietti wheat is given and its composition compared with that of hard, medium hard, and soft wheats.

Specimen pages of a pedigree register for cereal breeding purposes, W. Dix (*Mitt. Deut. Landw. Gesell., 21 (1906), No. 20, pp. 211–213*).—Samples of the register forms are given and their arrangement, value, and use described in detail.

References to recent work in plant breeding, C. Fruwirth (*Jour. Landw., 54 (1906), No. 2, pp. 139–158*).—About 40 references to books, bulletins, and articles treating of plant breeding are briefly given.

The Swedish plant breeding work at Svalöf, A. Ulander (*Jour. Landw., 54 (1906), No. 2, pp. 105–124, pls. 6*).—The methods of carrying on the work in plant breeding at this institution are briefly described. The author points out that the old so-called methodic selection did not give the results that were expected, and improvement of large numbers of individuals at the same time, even with the best equipment, does not lead to fixation and never to new varieties with good distinguishing characters. He believes that the improvement of agricultural plants must be based solely upon the laws of transmission and variation in the individual. The work must be conducted on a purely scientific basis and only morphological characters be taken into account. He is of the opinion that in this way the important and transmissible characters of a plant may be most easily found, and that it gives to the newly bred varieties characters which are not influenced by climatic and soil conditions. While this line of work can be satisfactorily conducted only in specially equipped institutions, the efforts of the practical farmer and seedsman are to be applied in maintaining the productivity and the purity of the new variety after it leaves the institution.

What benefit can the farmer derive from plant breeding, variety tests, and seed growing? C. Fruwirth (*Wie kann sich der Landwirt Pflanzen-*

züchtung, Sortenversuche und Saatgutbau zu Nutze machen? Berlin: P. Parey, 1906, pp. 65, figs. 4).—The topics discussed in this book are plant breeding and the application of its results, the testing of varieties and breeds, seed growing, changes in a variety when taken to another locality, and the maintenance of the standard of a variety in general farm practice.

On the adulterants and weed seeds in Kentucky samples of blue grass, orchard grass, timothy, red clover, and alfalfa seeds, H. Garman (*Kentucky Sta. Bul. 124, pp. 35, pls. 24*).—Brief notes are given on the adulterants of Kentucky blue grass, orchard grass, red clover, Mammoth clover, and alfalfa, as well as on weeds of which seeds were found in seed samples examined under the Kentucky law. The sections of the law referring to Canada thistles are reproduced.

HORTICULTURE.

Cyclopedia of American horticulture, L. H. Bailey and W. Miller (*New York: Doubleday, Page & Co., 1906, vols. 6, 4. ed., enl., pp. XLII+92+2016, pls. 145, figs. 2800*).—This work has been corrected in minor details, enlarged and increased in usefulness by the addition of a synopsis of the vegetable kingdom, with index of families and genera, making in all 92 pages of original matter. In the preface a rather extensive review is given of current horticultural progress. A large number of additional plates have been incorporated in the work.

Report of the South Haven Substation for 1905, T. A. Farrand (*Michigan Sta. Spec. Bul. 35, pp. 30*).—This bulletin is the regular annual report on the orchard and small fruits and nuts grown at the South Haven Substation, and is similar in character to the previous ones (E. S. R., 17, p. 37).

A number of early and late varieties of potatoes were tested, as well as remedies for the San José scale. The most effective remedy for San José scale was the lime and sulphur mixture either with or without salt, in the proportion of 25 pounds of lime and 15 pounds of sulphur, boiled 35 minutes. This remedy cost but one cent per gallon, while a number of commercial preparations tried cost $1.25 per gallon. The lime, salt, and sulphur mixture, as well as a number of commercial mixtures were also tried half strength on trees when in full leaf. All were more or less injurious. A commercial mixture, Scalecide, diluted to 1 to 20, was least injurious to the foliage, but even this did some injury. Sulphate of iron was used as a fungicide but proved without value as a spray on fruit trees.

Among the strawberries tested Bederwood and Gersonda stood out conspicuous, producing more fruit than any of the other varieties in either the old or new plantations. Notes are given on the varieties of currants, gooseberries, raspberries, blackberries, grapes, cherries, peaches, plums, apples, quinces, and chestnuts grown at the South Haven Station, with the results of spraying experiments in some instances and of a test of cover crops. The russeting of apples caused by spraying with Bordeaux mixture is believed to be due to the copper in the mixture, which in some way becomes soluble, since trees sprayed with sulphate of iron, Paris green and lime did not show the russeting, while it was quite apparent where sulphate of copper, Paris green, and lime were used.

Report of the horticulturist, G. F. Warren (*New Jersey Stas. Rpt. 1905, pp. 281–292, pl. 1*).—The author made a study of the peach orchards of the State, giving some attention also to apples and asparagus. Popular notes are given on the enemies of these crops, especially insect pests and fungus diseases, with suggestions for their control. With attention to spraying, the peach industry can again be put upon a paying basis.

Report of assistant in horticulture, JENNIE A. VOORHEES (*New Jersey Stas. Rpt. 1905, pp. 295–332, pl. 1*).—A further report is given on the fertilizer, irrigation, and variety tests of vegetables and small fruits started at the station some years ago and regularly reported upon since then (E. S. R., 17, p. 363). The yields secured with asparagus, raspberries, blackberries, gooseberries, currants, pears, plums, cherries, apples, and peaches under the different and combined methods of treatment are shown in detail in tabular form and discussed. The results are not markedly different from those reported last year.

Report of the botanist, B. D. HALSTED, E. J. OWEN, and J. K. SHAW (*New Jersey Stas. Rpt. 1905, pp. 423–509, 517–525, pls. 17, dgm. 1*).—The work of the year has been along the plant breeding lines outlined in former station reports (E. S. R., 17, p. 364). In addition to the work with many sweet-corn crosses, a study was made of 36 varieties of popcorns, 35 crosses of summer and several winter squashes, crosses of many varieties of eggplants, green and wax bush beans, tomatoes, and salsify. The details of the work and the results obtained with each of these crops are given at length.

In crossing tomatoes the hybrids obtained seem to follow closely the laws of inheritance as outlined by Mendel, standard size, fine leaves, yellow foliage, red fruit and smooth fruit being dominant characters as compared with dwarf size, coarse leaves, green foliage, yellow fruit and hairy fruit, respectively.

Hybrids of the scarlet runner bean (*Phaseolus multiflorus*) and bush bean (*P. vulgaris*) were profuse bloomers and produced pods and beans much like the Scarlet runner parent. No results have been secured in crossing Limas and bush beans. A fertile hybrid was secured between the scarlet Chinese eggplant (*Solanum integrifolium*) and the Fordhook Improved variety (*S. melongena*).

After nine years' observation the weed experiment at the station has been brought to a close, the perennial species finally gaining the upper hand.

Notes on breeding and selection experiments with morning glories, primroses, marshmallow, Rose of Sharon, daisies, etc., are given, as well as methods of removing and preserving seeds, keeping records, marking stakes, and making ink prints of vegetable fruits.

Report of the horticulturist, F. GARCIA (*New Mexico Sta. Rpt. 1904, pp. 32–35*).—An outline of the work of the year, with some data relative to a test of varieties of potatoes and the yield of onions secured at the station. Of the 4 varieties of early potatoes tested Early Six Weeks gave the best results, the yield being 86.67 bu. per acre. Celery was found to be pithy on the drier portions of the field, but where plenty of moisture was available this defect was not observed.

Importance of accurate descriptions, W. W. TRACY (*Amer. Florist, 26 (1906), No. 945, pp. 1128–1130*).—The desirability of accurate descriptions of varieties of vegetables in order that seed growers may produce plants true to type is pointed out. It is believed that if seed could be selected from plants of exact type for five generations, the improvement in seeds and market conditions would be greater than has come from the development of new varieties by hybridization or selection for the past 25 years.

Acetylene light for forcing plants, M. J. IORNS (*Cornell Countryman, 3 (1906), No. 8, pp. 183–185, figs. 2*).—The author first demonstrated the absence of any injurious qualities in acetylene light. Further, it was found that plants may be grown successfully in acetylene light without any sunlight whatever, though the plants are not quite as green as when grown in sunlight. In using it as a forcing agent it was found that as a general thing the warmer the house and the more sunshine the plants received the less visible was the effect of the acetylene light on the plants.

Sweet peas under the influence of acetylene light blossomed 5 weeks earlier than those not receiving the light. Easter lilies also responded promptly to the effects of the light. On the other hand, tomatoes, pole beans, and leeks showed little, if any, response to the light. The results secured with root crops were inconclusive.

It is concluded that with some special crops acetylene light will prove of undoubted commercial value. It is the nearest to being a complete substitute for sunlight that the author has found.

Forcing plants by means of ether, J. E. Howitt (*Cornell Countryman, 3 (1906), No. 8, pp. 187, 188, figs. 2*).—Persian lilacs, subjected to fumes of ether November 24, were in full bloom December 25, 6 days earlier than those not etherized. When the plants were etherized 48 instead of 24 hours they bloomed 8 days earlier, and when etherized 72 hours 10 days earlier than unetherized plants.

When *Astilbe japonica* was etherized 24 hours it was in full bloom a month to 5 weeks ahead of another clump not etherized.

The book of rarer vegetables, G. Wythes and H. Roberts (*London and New York: John Lane Co., 1906, pp. 109, pls. 7, figs. 30*).—Brief directions for the culture and culinary uses of a large number of the more rare garden vegetables. Among the more unusual described may be mentioned chervil, chick-pea, chicory, coco, commonly known as *Colocasia esculenta*, evening primrose, good King Henry (*Chenopodium bonus*), hops, nettles, oxalis crenata, patience (*Rumex patientia*), black Congo potatoes, fir apple potatoes, quinoa (*Chenopodium quinoa*), rampion (*Campanula rapunculus*), rocambole (*Allium scorodoprasum*), scurvy grass (*Cochlearia officinalis*), skirret (*Sium sisarum*), sorrel, soy beans, sweet cicely, tuberous glycine (*Apios tuberosa*), etc.

Development of the Rockyford cantaloupe industry, P. K. Blinn (*Colorado Sta. Bul. 108, pp. 17*).—A historical account is given of the development of the cantaloupe industry at Rockyford from the first plantings to the present time. During the past 9 years 5,999 acres of cantaloupes have been shipped out of the Rockyford district. The yearly average is 666 acres. The largest number was shipped in 1904—1,182 cars. The cars used at present are 40 ft. long and carry 366 standard crates of 66 lbs. each. The Market Development of the Rockyford Cantaloupe is treated by H. Woods, and the Early Market Conditions of Cantaloupes on the New York Market, by Lyon Bros. Co. A brief paper on The Cataloupe From a Luxury to a Necessity, by M. O. Coggins, is also included.

Onion growing, R. W. Fisher (*Montana Sta. Bul. 60, pp. 119-130*).—This bulletin contains the results of experiments in growing onions for three years, both from seed sown in the open and sown in greenhouses and transplanted. The period between killing frosts in Montana is placed at 100 to 120 days, while the time required for onions to mature from seeding is 135 to 150 days, and if onions are not thoroughly ripe their keeping quality is injured. The experiments are recorded in detail for each year and yields given by both methods of culture.

Generally speaking, the yields from transplanted onions were from 50 to 200 per cent larger than from seed sown in the field, while there was but little or no increase in cost of labor. The transplanting insures an even crop, the maturity of the crop, and the keeping quality of the onions. Prize Taker gave the largest average yield of the 19 varieties grown, and was one of the best keepers, though not usually advertised as a winter onion. The seedling bulbs of this variety, however, kept poorly because the growing season was not long enough to properly mature them. The use of well-rotted manure increased the

yield of both field-sown and transplanted onions. Suggestions are included for making hotbeds.

Notes on the truffle, E. BOULANGER (*Lons-le-Saunier: Lucien Declume, 1906, pp. 16, pls. 4*).—This pamphlet is made up of three papers presented before the Société Mycologique during the years 1904 to 1906 supplementing the author's work previously noted (E. S. R., 15, p. 472). In these articles various phases of truffle culture and spore germination are considered.

The best fruits for all sections, S. W. FLETCHER ET AL. (*Country Life Amer., 9 (1906), Nos. 5, pp. 571–574, 598; 6, pp. 760, 762, 764; 10 (1906), No. 1, pp. 100–106*).—A general discussion on the selection of fruits of high quality and planting, with recommendations as to varieties of orchard, bush, and other small fruits for each of the different States and Canada, the varieties suggested being largely those recommended by the horticulturists of the experiment stations.

Effects of stocks upon varieties, A. G. GULLEY (*West. N. Y. Hort. Soc. Proc., 51 (1906), pp. 14–20*).—Sweet Bough and Jersey Black varieties of apples were used as stocks upon which Red Canada and Red Astrachan were worked. No effect of the stocks upon the quality of the fruit could be detected. The use of Northern Spy as a stock did not delay the fruiting period of Jonathan or Red Canada worked upon it, showing again no visible influence of the stock on the scions.

Influence of bagging on the quality of fruit, M. GARNIER (*Rev. Hort. [Paris], 78 (1906), No. 9, p. 208*).—An account is given of some experiments carried on by Messrs. Rivière and Bailhache at the agronomic experiment station at Versailles on the composition of fruits as affected by bagging. Grapes and pears were the fruits investigated. The analysis of the fruit thus produced showed that the bagged grapes contained 205 gm. of sugar per liter of juice, while in the fruit not bagged there were but 198.5 gm. The acid content of the fruit grown in the bags was 2.86 gm. per liter of juice, and in the open 3.08. In the case of the pears, likewise, the total sugar content of the pulp in the bagged fruit was greater than in the fruit grown in the open. The acid content of the pears grown in the bags averaged 2.30 gm. per 1,000 parts of fresh pulp, as compared with 1.75 gm. for fruit grown in the open.

Fertilizer experiments with grapes, E. ZACHAREWICZ (*Prog. Agr. et Vit. (Ed. l'Est), 27 (1906), Nos. 4, pp. 118–122; 6, pp. 171–174; 7, pp. 215–218*).—Numerous experiments were made with fertilizers on different soils. Analyses are given of the soils and details of the results secured. The general conclusions drawn from the experiments are to the effect that nitrate of soda associated with sulphate of potash and superphosphate of lime is a valuable fertilizer, increasing the yields, hastening the maturity, and raising the sugar content of the fruit. In order to obtain maximum results with this manure, the sulphate of potash and superphosphate of lime should be applied in the fall and worked into the soil, the nitrate of soda being added the following spring in March or April, and also worked in.

The Görz prune industry with special reference to sulphuring the fruit, A. DEVARDA (*Ztschr. Landw. Versuchsw. Oesterr., 9 (1906), No. 4, pp. 485–639*).—An account of the prune industry in the vicinity of Görz with the result of studies of various factors in the process of manufacture with the idea of improving the product. Only well-ripened fruit should be used for drying. The dried product should not contain over 25 to 30 per cent of moisture. In sulphuring the fruit not over 5 to 6 pounds should be used per hundred pounds of fruit, the duration of the sulphuring to last 20 to 30 minutes. In rainy weather sulphuring every 4 to 5 days is necessary. The time for each sulphuring under such conditions should not exceed 15 minutes. When pleasant weather again returns

the sulphured fruit should be fully exposed to sunlight and fresh air. Prunes in storage a year lose practically all the sulphuric acid they contain. A chemical study was also made of the free and organic sulphur in prunes and of the effect on the sulphur content of different methods of preparation for table use.

Home preservation of fruits, HENRIETTA W. CALVIN (*Industrialist, 32 (1906), No. 34, pp. 533–535*).—As a result of some experiments along this line, it is calculated that a bushel of peaches will can 16 to 20 qt.; blackberries and raspberries 13 to 17 qt. per crate; tomatoes 13 qt. to the bushel; grapes 1 pt. of juice to each 2 lbs. of fruit; medium-sized pineapples, 1 to a pint jar. With grapes 1 qt. of juice and 1.5 lbs. of sugar produced 6 glasses of grape jelly.

Preventing the decay of ripe fruit, T. R. SIM (*Natal Agr. Jour. and Min. Rec., 9 (1906), No. 3, pp. 202, 203*).—Strawberries and Cape gooseberries were dipped in a formalin solution to prevent rot. The results were practically a failure as the dipped berries did not keep in good condition any longer than the untreated fruit and were greatly injured in appearance.

Utilizing waste apples, G. T. POWELL (*Amer. Agr., 78 (1906), No. 2, p. 24, fig. 1*).—The author gives a drawing and detailed description of his two-story evaporating plant, and describes its method of operation, methods of packing the product, and the grades put up and prices received. It is stated that Baldwins will produce 6.5 lbs. of dried fruit to the bushel, Greenings 6 lbs., King 5.5 lbs., Ben Davis 4.75 lbs., Gilliflower 4.5 lbs., Twenty Ounce 5 lbs., Belleflower 5.5 lbs., Seek-no-Further 4.5 lbs., and Roxbury Russet 9 lbs.

Small fruits in 1905, J. P. PILLSBURY (*Pennsylvania Sta. Bul. 77, pp. 10*).—Popular data are given on the results secured in testing 48 varieties of strawberries, 27 of raspberries, 20 of blackberries, 2 of dewberries, 12 of currants, and 10 of gooseberries, with notes on the more important varieties.

Varieties of raspberries and blackberries, with cultural directions, O. M. TAYLOR (*New York State Sta. Bul. 278, pp. 111–151*).—Notes are given on the varieties of raspberries and blackberries cultivated at the station during the past 8 years, with general cultural directions and descriptions of a number of varieties of each. Among the red raspberries Cuthbert is stated to be the most popular variety throughout the State. Cline is an early variety, but the fruit is small and the plant unproductive. King and Royal Church are inclined to crumble. Marlboro is rather dwarf but very productive. The fruit of the Turner variety is considered too small.

The author states that purple raspberries are superior for canning. Their value for this purpose is not fully appreciated. Both Columbian and Shaffer are desirable kinds. Haymaker is productive and a promising variety.

Black raspberries require frequent renewal because of injury from anthracnose. A new variety, Beyer, ripens its fruit on the current season's growth, but it has not as yet shown many desirable characters. The varieties Cumberland, Gregg, Mills, and Onondaga produce fruit of excellent size and quality. Among the more desirable early kinds are Eureka, Mohler, and Palmer.

Agawam and Ancient Britain are among the better blackberries, producing large crops of berries medium to above in size. Snyder is the most cosmopolitan of all the varieties, very hardy and productive. Many varieties of blackberries require winter protection.

In the notes on the various varieties of berries a discussion is given of their earliness and hardiness, and descriptive and historical data given.

Raspberries and blackberries, O. M. TAYLOR (*New York State Sta. Bul. 278, popular ed., pp. 12*).—A popular edition of the above.

Table of the principal kinds of teas and representative tea-growing districts of the world (*Tea and Coffee Trade Jour., 10 (1906), No. 4, pp. 196,*

197).—An extensive table showing the various tea districts in the world and the kinds of teas produced in each.

The fermentation of tea, I, H. H. MANN (*Indian Tea Assoc.* [*Pamphlet*], *1906, pp. 22).*—Three former reports have been issued by the author on this subject (E. S. R., 17, p. 254), in which it has been shown that the oxidizing enzym developed during withering is the principal and probably the only active agent in bringing about the changes of color and flavor which take place during fermentation. In the present report the changes which take place in some of the constituents of the tea itself, more specifically the tannin, are considered.

The marketable value of tea is closely connected with the quantity of tannin which may be easily extracted from the tea by boiling water. Caffein, which is the principal stimulating material of tea, does not bear a close relationship to market value. In good teas it appears to be present in quantities varying from 3 to 5 per cent, and in the lowest grades it may go down to 2 or 3 per cent. Analyses are given of several samples of tea to show that the market value is closely related to the total soluble matter and tannin content. Tannin is the chief source of pungency in teas, and is caused in greatest measure by the unfermented tannin. The color of the liquor, on the other hand, is caused chiefly by the fermented tannin. The body of the liquor is measured principally by the total soluble matter, of which a large part is tannin, fermented and unfermented.

The tannin in the leaf appears to be combined with sugar. During fermentation the enzym of the tea causes slight oxidation of the tannin, as a result of which the sugar is separated and the tannin undergoes a loss of water and the colorless tannin of the tea leaf is transformed into brown products.

In investigations on the withering of tea it was found that "(1) The soluble matter and the soluble tannin in the leaf increase during the withering process, so long as the leaf does not dry up. (2) This increase in the important constituents of the leaf continues right through the process, so long as no drying takes place. . . . (3) So soon as the drying of the leaf takes place, a large reduction in the amount of soluble matter and soluble tannin is noticed."

Data are given which show that during fermentation a considerable reduction in the amount of soluble matter and soluble tannin in the leaf takes place, and this is increased with heavy rolling. In the absence of fermentation organisms it was found that normal fermentation of the leaf is complete in about 5.5 hours at most, including the rolling, where the temperature is maintained at 80° F. In fact, very little change takes place after 4 hours have passed. At a temperature above 85° F, a darker brown oxidation product of tannin is produced which is completely insoluble in water, the formation of which rapidly reduces the pungency, color, and body of the liquor and therefore greatly injures the quality of the tea. Among the practical conclusions reached is, that in order to make the best tea the temperature of the fermenting room must be kept down to 82° F. Suggestions are given on the construction of fermenting houses whereby this temperature may be maintained. This temperature, with a saturated atmosphere, and the absence of injurious organisms are believed necessary conditions to the manufacture of the best tea.

Some observations were made to determine the effect of light on fermentation, as some planters use yellow, some red, and some blue light in this process. The rapidity of fermentation was practically the same under white, red, and yellow light, but was less rapid under a blue light. No difference was noticed in the percentage of tannin, but only in the total soluble matter. The ultimate result was the same whatever the lighting used, providing direct sunlight and

glare were avoided. It is believed that where extremely short fermentations are given the blue light may have some advantage in producing better colored tea.

Investigations on the effect of thickness of spreading on the fermenting floor indicate that if the thickness did not go beyond 1.5 in. there was no noticeable difference in the results. Investigations in firing indicate that until the leaf is crisp or until no juice remains unsolidified, drying should be as rapid as possible, and at as low a temperature as possible, providing it is high enough to stop the normal fermentation of the leaf at once.

Relative to the absorption of moisture by made teas, it is found that teas when packed contain normally 2 to 3 per cent of moisture, when exposed for 15 hours the sample examined contained 9.6 per cent of moisture, after standing 26 hours, 10.4, and after standing 136 hours, 16.4 per cent. No marked change in the composition of the tea occurred, but when the tea was allowed to absorb moisture at a temperature of 90 to 100° F. for 17 hours there was a loss of both soluble matter and soluble tannin.

The renovation of deteriorated tea, H. H. MANN (*Agr. Jour. India, 1 (1906), No. 2, pp. 83–96*).—The author discusses the deterioration in tea plantations due to unfavorable physical conditions of the soil, exhaustion of plant food, bad pruning, etc., and suggests methods of correction.

Packing cocoa seeds (*Mo. Consular and Trade Rpts.* [*U. S.*], *1906, No. 306, p. 115*).—It is reported that excellent results have been obtained in packing cocoa seeds for export by selecting seeds from ripe pods, thoroughly washing them in water and then gently rubbing them with a rough towel in order to remove most of the pulp. The seeds are then cooled in a current of air for 24 hours and packed in a material composed of equal parts of vegetable mold and finely ground powdered charcoal moistened just enough to resemble earth taken out of a shady place. The seeds are shipped in a tin box 8 by 4 by 4 in. A layer of earth and charcoal about ¾ in. deep is placed in the bottom of the box and then a layer of seed, leaving a little space between each seed, followed by a layer of charcoal and earth and then of seed until the box is full.

A neglected nut, J. W. KERR (*Country Gent., 71 (1906), No. 2786, pp. 594, 595, figs. 2*).—Shellbark hickory nuts from exceptionally good trees were secured in Pennsylvania and planted by the author in Maryland. They were from 13 to 15 years in coming into bearing. Ten of the better varieties thus obtained are briefly described and illustrations given of the nuts.

The seasons in a flower garden, LOUISE SHELTON (*New York: Charles Scribner's Sons, 1906, pp. 117, pls. 4*).—A popular garden book giving specific directions for the planting of different kinds of flowers and the work to be done in the garden during each month of the year.

The amateur gardener's rose book, J. HOFFMANN (*London, New York, and Bombay: Longmans, Green & Co., 1905, pp. XVI+155, pls. 20, figs. 16*).—This book has been translated into English by John Weathers and is intended primarily as an adviser to garden lovers who devote special attention to roses. It treats principally of the varieties grown in Germany and England. A feature of the work is 20 colored plates of as many different varieties of roses.

Handbook on pruning roses (*Croydon, Eng.: National Rose Society, 1906, pp. 83, figs. 14*).—Directions are given for pruning the different kinds of roses grown in England. Numerous illustrations are given to supplement the written descriptions.

A manual on the phlox, C. S. HARRISON (*York, Nebr.: 1906, pp. 31, figs. 6*).—This manual treats of the character and culture of different varieties of phlox, and is intended for the use of the nurseryman and amateur. Suggestions are also given on the showing of phlox and on the origination of new varieties.

The preservation of cut flowers, L. FOURTON and V. DUCOMET (*Rev. Hort. [Paris], 78 (1906), No. 11, pp. 260–262*).—The results are given of experiments in preserving cut flowers by adding to the water in which they are kept various mineral and organic acids, bases, salts, antiseptics, etc. The flowers used were violets (*Viola odorata*), *Ficaria ranunculoides*, *Narcissus poeticus*, iris (*Iris germanica*), stellaire (*Stellaria holostea*), *Fumaria borei*, *Myosotis alpestris*, asperula (*Asperula odorata*), marguerite, seringal (*Philadelphus coronarius*), *Silene pendula*, snapdragon (*Antirrhinum majus*), and primrose.

The various materials were used in concentrations varying from 5 to 1,000 gm. per hectoliter. The test showed that it was advisable to use mineral materials in solutions less concentrated than 100 gm. per hectoliter. A mixture of mineral and organic materials did not give as good results as either alone. The length of time which each of the different flowers mentioned above could be kept by the various chemicals used is given in detail.

The following materials have proved useful in prolonging the life of cut flowers: Chloral, sugar, limewater, potash, etherized water, nitrate of potash, kainit, sulphate of potash, phosphate of potash, phosphate of ammonia, chlorid of calcium, glycerin, and alcohol. Mineral substances have been favorable in very weak concentrations—1 to 10,000—and organic materials have given favorable results in concentrations of 1 to 10 per cent. One of the conditions which has influenced the keeping quality of the flowers has been the distance of the surface of the liquid from the base of the flower. The keeping quality was longest when this distance was least. Flowers keep as well when cut as when left on the plant, providing water is supplied to the cut stems and putrid fermentation is prevented. The work is to be continued.

The effect of different chemical substances on the flowers of plants, J. C. HOGENSON (*Cornell Countryman, 3 (1906), No. 8, pp. 188–190, fig. 1*).—The effect of iron filings, copper sulphate, sugar, lime, salt, potassium hydroxid, iron sulphate, alum, and many other substances on the color of flowers, when added to the soil in which they were grown, was studied. So far as the experiment has gone it shows that with quickly-growing plants like narcissus and lily-of-the-valley no effect is noticeable. Azaleas and rhododendrons, which normally grow on acid soils, were successfully grown on limestone soils when these soils were made acid. This was conveniently done by adding magnesium sulphate, "which upon coming in contact with moisture of the soil hydrolizes and forms magnesium hydroxid and sulphuric acid. The magnesium is absorbed by the soil and plant, thus setting the sulphuric acid free. This tends to neutralize the lime by acidifying the soil. Pyrogallol, tannic acid, and hydrochloric acid will also neutralize lime, but care must be taken not to put in too much. The results of this experiment are quite satisfactory."

Forcing bulbs by means of ether, C. I. LEWIS (*Cornell Countryman, 3 (1906), No. 8, pp. 190, 191, fig. 1*).—A large number of varieties of bulbs, such as narcissus, tulips, hyacinths, alliums, callas, gladiolus, lilies, etc., as well as seeds, were subjected to fumes of ether, using an ounce of sulphuric acid for every 14 gal. of space for a period of from 24 to 72 hours. Smaller amounts of ether were also used. With narcissus the gain in time of blooming from etherization was from 2 days to 3 weeks. With *Lillium longiflorum* var. *multiflorum*, there was no gain in early bloom, but a decidedly taller growth. With a longer exposure there was a considerable gain in time of blooming as well as in height.

Etherized seeds, such as peas, beans, radish, melon, lettuce, and onion, germinated sooner and more uniformly than unetherized seeds.

Wild flowers worth cultivating, W. MILLER (*Country Life Amer., 10 (1906), No. 3, pp. 322–327, figs. 15*).—Six types of wild gardens, including bog

gardens, water gardens, rock gardens, etc., are described and the kinds of wild flowers used in planting them noted. Tables are given showing the common name, season of bloom, color, etc., of a large number of annuals and perennials which may be used in making wild-flower gardens.

FORESTRY.

Exotic forest and park trees for Europe, H. Mayr (*Fremdländische Wald- und Parkbäume für Europa. Berlin: Paul Parey, 1906, pp. VIII + 622, pls. 20, figs. 258*).—The trees described in this work are those grown primarily in North America, northern Mexico, Japan, Korea, Siberia, and northern China. Forestry conditions in these countries are described, based upon the author's personal observations, and the forest zones in the different countries outlined and compared with those of Europe. The cultural requirements and the uses of the various exotic trees dealt with are given with an account of their botany and correct nomenclature. General rules for the culture of exotic trees in Europe are given with plans for their culture in parks and forests.

Principles involved in determining forest types, R. Zon (*Proc. Soc. Amer. Foresters, 1 (1906), No. 3, pp. 179–189*).—This is a general paper on the subject in which it is held that a study of the life habits of forest trees and the establishment of forest types must go hand in hand. Yield and volume tables should be made separate for each type. If sylviculture is to be placed on a safe basis each forest should be divided into permanent, natural forest types, or types of situation with forest growth corresponding to them in a manner similar to that of mapping soil types. It is held that when the laws of development and growth have been established for a forest type it will hold good for the same forest type everywhere, thus giving to sylvicultural deductions the character of scientific truths of a wide application.

The rôle of light in forests, A. Giesler (*Centbl. Gesam. Forstw., 32 (1906), Nos. 2, pp. 49–73; 3, pp. 97–122, dgms. 4*).—Results and many of the details are given of extensive investigations to determine the effect of light on the crown and stem development of forest trees thinned to different degrees, and the corresponding floral development of the forest floor.

It appears that the crowns even of strongly lighted forests hold back a large portion of the chemical light rays. In the case of Austrian black pine this was found to be 60 per cent, fir forest 80 per cent, and red beech 90 per cent. The numerous small trees of lightly thinned forests do not retain proportionally as many of the chemical light rays as less numerous but more thickly leaved crowns of the larger trees found in more heavily thinned forests. Moderately thinned and heavily thinned forest trees contain practically two and four times as extensive a leaf area respectively as thinly forested trees.

A limit was found in the case of red beech, over which the mass production was no longer proportional with the increase in crown growth. Photometric studies with this tree favor thinning in the dominant condition, but not in the dominated.

When only 40 per cent of the chemical light rays reach the soil, the flora develops to such an extent as to hinder natural regeneration. In thickly closed stands of light-demanding trees the abundance, vigor, and number of species of plants on the forest floor were incomparably smaller than in a stand of tolerant trees, a fact of importance in the natural regeneration of such woods. Perennials made up 80 to 96 per cent of the flora species of forest floors.

Practical suggestions for the Massachusetts tree planter, R. C. Hawley

(*Mass. Forester's Off. Bul. 4, pp. 23, fig. 1*).—Suggestions are given for the preparation and care of a forest nursery, treatment in the nursery of the more important trees, planting out seedlings, with a discussion of the best species to plant, protection from fire, the cost of forest planting, and the returns to be expected from plantations.

The forestry problem in Canada, E. STEWART (*Ann. Rpt. Ontario Agr. and Expt. Union, 27 (1905), pp. 46–59*).—The author estimates the total amount of timber fit for lumber and pulp wood now growing in Canada at 532,000,000,000 ft. and the forest area at about 266,000,000 acres. In addition to this amount of timber there is an immense quantity that has not yet attained sufficient size for cutting.

Forestry in the East Africa Protectorate, E. BATTISCOMBE (*Indian Forester, 32 (1906), No. 3, pp. 115–120, pls. 2*).—The present activities of the conservator of forests in the East Africa Protectorate are to stop the encroachments of the natives in the destruction of the forests; to properly define the boundaries of the forests, and to find out the amount of timber available for extraction. A description of the forests at different altitudes from 5,000 ft. up is given.

Between the altitudes of 5,000 and 6,000 ft. the forests are composed essentially of hard wood of no great size. From this distance to 7,500 ft. the forests are varied, consisting of hardwoods and many quick-growing, large-leaved species. Juniper (*J. procera*) begins to appear at an elevation of 5,500 ft. and gradually increases in quantity with the elevation. This is the most useful forest tree in the country. Podocarpus begins at an elevation of about 7,000 ft.

Both these conifers flourish at an altitude of 8,000 to 8,500 ft., the former being found pure on the dry wind-swept hillsides, the latter preferring the deep soil of the broad-leaved forests but never found pure.

Bamboos appear at an elevation of 8,000 ft., while the tree limit is reached at about 8,500 ft. Rubber, derived chiefly from the species Landolphia, is found over nearly the whole of the Protectorate. A description is given of a small block of forest for which a working plan has recently been made.

Notes on the commercial timbers of New South Wales, J. H. MAIDEN (*Sydney: Govt. Printer, 1904, 2. ed., pp. 42, pls. 9*).—Popular information is contained in this pamphlet relative to the principal commercial timbers of New South Wales. The timbers of New South Wales are classified, their characteristics and principal uses pointed out, as well as their distribution, and the quantity available. The timbers are classified also as to special purposes for which they may be used.

Chaparral as a watershed cover in southern California, L. C. MILLER (*Proc. Soc. Amer. Foresters, 1 (1906), No. 3, pp. 147–157*).—A partial list of the species of trees forming the chaparral in southern California is given, with notes on the density of the chaparral in the Pasadena and Santa Ana watersheds at different elevations. The density of the chaparral appears to increase with the height from 2,000 to 3,000 ft. on east, south, and west exposures, and decreases in passing from the lower to the higher zones on northern exposures. In the improvement of California watersheds, it is stated that the question of fire protection must be solved before successful reforestation can be carried out.

Transverse test of Catalpa speciosa (*Arboriculture, 5 (1906), No. 4, p. 109*).—The results are given of two bending tests of this species of catalpa, using posts 3.5 in. in diameter and 8 years old. The average load carried when the distance between each post was 4 ft. was 795 lbs., and when the distance was 2 ft., 1,243 lbs.

How spurious seed is disseminated (*Arboriculture, 5 (1906), No. 4, pp. 113, 114*).—The results of an examination of 21 samples of catalpa seed from 19

firms are given. In every case the catalpa seed was bought for *Catalpa speciosa*. Nine of the samples were found to be *Speciosa bignonioides*, while a number of others were hybrids. Only 3 of the samples were pure *Catalpa speciosa* seed.

Grafting chestnuts on oak for the reconstruction of chestnut orchards, BINON (*Bul. Soc. Nat. Agr. France, 66 (1906), No. 4, pp. 345–348*).—Of the oaks with which the author worked *Quercus pedunculata* seemed to be the only one which he could recommend as a stock for chestnuts. Tests with the American red oak did not give satisfactory results. Grafting by the flute or whip method is recommended, the operation being performed when vegetation commences in the stock.

On the increment and form of growth of larch trees, G. SCHOTTE (*Skogsvårdsför. Tidskr., 4 (1906), No. 1, pp. 18–23, figs. 3*).—Siberian larch grown in Sweden was found to have an average height, when 2 years old, of 18.7 cm. (range 9–28 cm.), and European larch, 12.1 cm. (range 5–19 cm.). The former were of straight growth without many branches, while the latter ramified strongly even the first or second year and acquired a shrublike habit of growth.—F. W. WOLL.

Litter experiments in large pine forests, K. BÖHMERLE (*Centbl. Gesam. Forstw., 32 (1906), No. 4, pp. 145–165, figs. 7*).—The amount of litter produced and the increment growth on separate areas in forest are given for 5 year periods for the 20 years from 1882 to 1903. In one case the trees were 37 years old at the beginning of the experiment, and in the other 57 years old. In some instances the litter was removed annually and in others at the end of 5 years, and in still others not removed at all. When the litter was harvested yearly, about four cords or 3,000 pounds dry matter per acre was secured. When harvested at the end of five year periods, only 51 to 53 per cent of the average yearly leaf fall was secured, owing to the decay of the older matter. The removal of litter had but little effect on tree growth, probably due to the stimulation from annual raking and to the deleterious effects of moss growth which was greatest on the plats raked only every 5 years. The data are given in extensive tabular form largely as a report of progress.

On the drying up of pine forests in northern Sweden in the spring of 1903, G. ANDERSON (*Skogsvårdför. Tidskr., 3 (1905), No. 12, pp. 449–477, figs. 7, map 1*).—The disease manifested itself in the drying up of more or less of the new tip growths, some districts being much more affected than others. The cause could not be determined with certainty, but is thought to be due to unfavorable weather conditions. A résumé in German is given and a map showing the affected districts.

Size of seed as related to vigor of germination and seedlings, G. EISENMENGER (*Österr. Forst u. Jagd Ztg., 24 (1906), No. 22, pp. 185, 186, figs. 6*).—As the result of experiments with seed of spruce, Scotch and Austrian pine, the author found that large seeds germinated quicker and reached the period of maximum germination earlier than small seeds. The dark-colored seed of spruce and Austrian pine gave a larger percentage germination than light-colored seeds, while large dark-colored seed of both these trees produced much larger and more vigorous seedlings than large light-colored seeds. Small light-colored seeds produced the weakest seedlings of all.

Rubber culture in the Philippine Islands, W. I. HUTCHINSON (*Forestry and Irrig., 12 (1906), No. 5, pp. 230, 231*).—An account is given of the planting of Para, Ceara, Castilloa, and Rambong seed during the year 1905, with some measurements of seedlings with reference to growth. Para rubber seedlings in 50 days averaged 15 in. in height. Ceara seedlings 7 months and 5 days

old averaged 12 ft. 5 in. in height. At a lower elevation the average height was 9 ft. 9 in. Castilloa seedlings about 5 months old averaged 17 in. in height.

History of a rubber creeper in tropical Africa (Landolphia dawei), M. A. CHEVALIER (*India Rubber Jour., n. ser., 31 (1906), No. 10, pp. 514–517*).—This article is a translation of the official report of the Botanical Society of France, and contains a botanical description of *Landolphia dawei, Clitandra elastica,* and *L. turbinata.* It is held that the *L. florida* of Dr. Preuss is identical with *L. dawei.* This creeper is believed to be the most promising rubber plant of a creeping nature now known with reference to tropical agriculture.

Coagulation of Castilloa rubber, S. W. SINCLAIR (*Bul. Dept. Agr. [Jamaica], 4 (1906), No. 5, pp. 99, 100*).—The author's method of coagulating Castilloa rubber consists essentially in the use of a box about 1.25 in. deep with a filter-paper bottom. When the latex is brought in from the field, about 4 times its volume of water is added. The mixture is then strained and allowed to settle in a cone bottom tank, after which the water is decanted off and the latex poured into the box. The surplus water rapidly passes through the filter paper and the remaining rubber layer is exposed to a heat of 110° F. for 5 to 6 hours. After being used 10 or 12 times the filter paper must be replaced. This method is suitable for Castilloa only. The Hevea latex passes through the filter paper.

Exportation and packing of Hevea seeds, U. BERNARD (*Jour. Agr. Trop., 6 (1906), No. 58, pp. 99–101*).—An account is given of sending hevea seeds from Penang in the Malay States to Holland, packed as follows: 1 and 2, charcoal saturated with benzine; 3, charcoal; 4, dried leaves; 5, sand, the seeds being first previously well dried; 6, sawdust; 7, sawdust saturated with benzine. None of the seed germinated which had been packed in material saturated with benzine. Seeds packed in charcoal alone gave 66 per cent germination; in sand and dried leaves, 46 per cent, and in sawdust, 25 per cent.

DISEASES OF PLANTS.

Report of the botanist, G. P. CLINTON (*Connecticut State Sta. Rpt. 1905, pt. 5, pp. 263–330, pls. 13, figs. 2*).—Notes are given on various fungus diseases observed during 1905 and accounts of investigations made upon the downy mildew (*Phytophthora phaseoli*) of Lima beans and the downy mildew or blight (*P. infestans*) of potatoes.

During the season of 1905 fungus diseases on the whole were less troublesome in Connecticut than for several years previous, and the author calls attention to a number which have not hitherto been reported as occurring within the State. Among these were a fruit speck of apples due to an undetermined species of fungus, and a pod and leaf blight of Lima beans, which resembled that described as due to *Phoma subcircinata,* although the author states that his specimens did not agree with the description of that fungus and that the fungus might be a species of Ascochyta, possibly *A. phaseolorum.* Among the other diseases described are leaf scorch of the sugar maple, which is due to some physiological disturbance, probably drought or winter injury to the roots; wilt of okra, and a disease of onions to which the name brittle is given and which is believed to be caused by a species of Fusarium. This disease is generally characterized by the brittleness of the onion leaves, and from this character its name is taken. An examination of the above-ground parts failed to reveal the presence of any insect or fungus attack, but when the underground portions were examined the smaller roots were found to possess irregular swellings, and when examined microscopically the mycelium of some fungus was found present. Specimens exposed in moist chambers for several days developed a fungus that is believed

to be species of Fusarium. Experiments with soil taken from infested fields produced the disease, and as the trouble is apparently due to some soil fungus, a rotation of crops, the use of commercial fertilizers, etc., are recommended.

The author also reports the occurrence of *Botrytis patula* on raspberries, causing a gray mold, and associated with it was the cane wilt fungus (*Leptosphaeria coniothyrium*). The occurrence of *Heterosporium variabile* on spinach leaves, producing the leaf mold, is mentioned, and while the fungus does not appear to be a very vigorous parasite, yet the spots caused by it on the leaves depreciate the market value of the spinach to a considerable extent. A brief account is also given of the damping off of tobacco plants, which was suspected as being due to a Rhizoctonia, but an examination of specimens did not reveal this fungus in any of the young plants. Cultures of diseased material were made, and while they never produced any spores the sclerotia formed resembled those attributed to Sclerotinia, and it was thought possible that the fungus in this case was a species of that genus.

In the studies on the Lima bean mildew the author reviews the previous investigations, describes the various stages of growth, and reports having found the oospores, thus completing the life cycle of the organism. Attention is called to the fact that, aside from notes on the limited distribution of the Lima bean mildew, practically all that is known about it has been worked out by the various botanists connected with the station. The microscopical characters of the fungus are described at considerable length, and the oospores, which the author was the first to discover, are found in the seed coats and cotyledons of the seeds and to a limited extent in the tissues of the pods, but not in the stems or leaves. Artificial cultures were successfully made, and both conidial and oogonial stages were formed. The presence of the oospores in the seed emphasizes the necessity for proper selection as a precaution against the disease, but in addition the rotation of crops, the destruction of rubbish, spraying, proper cultivation, etc., are recommended. A bibliography of literature relating to this fungus completes the account of this disease.

In continuation of the work of the author in 1904 (E. S. R., 17, p. 153), studies were carried on on the downy mildew or blight (*Phytophthora infestans*) of potatoes, the author seeking to determine the means by which the fungus first infects the vines in the summer, the means by which it is carried over from year to year, the inoculation of the tubers, etc. The author believes that one of the means of primary infection is through the contact of the leaves with the ground at critical wet periods during July and August, when the germs of the blight are probably first generally available in the soil for infection. While the author has not yet determined from his own observations whether the fungus is carried over the winter in the soil, so far as the observations go they seem to indicate that blight starts earlier and more vigorously in fields that bore a blight-diseased crop the year before, and such factors as earliness of planting, situation of land, previous crop, etc., must be considered. Notes are given on secondary infections, growth in artificial cultures, perpetuation of the fungus, etc., and in commenting on the delayed appearance of the blight, the author advances the opinion that its appearance in July and August is to be attributed possibly to the fact that the mycelium from primary infections on young, rapidly growing tissues remains localized until after vegetative growth of the host ceases and then renews its activity on the appearance of favorable weather conditions. If the primary infections take place, as the author believes, by contact of the leaves with the ground, this would best be accomplished after the plants have attained full growth.

Plant diseases of the year, W. PADDOCK (*Colorado Sta. Rpt. 1905, pp.*

44–46).—Brief accounts are given of diseases observed during the year. Among them are grape mildew, peach mildew, raspberry yellows, asparagus rust, bacterial blight to tomatoes, strawberry leaf blight, and Rhizoctonia of sugar beets.

Report of the horticulturist, F. M. Rolfs (*Florida Sta. Rpt. 1905, pp. 29–47*).—A report is given of observations made relating to the diseases of a large number of plants of economic importance, the diseases being listed under the different host plants. Directions are given for the preparation and use of a number of standard fungicides.

Fungi as related to weather, B. D. Halsted, E. J. Owen, and J. K. Shaw (*New Jersey Stas. Rpt. 1905, pp. 516–517*).—A tabular account is given showing the rainfall, temperature, and sunshine, and also statements regarding the occurrence of plant diseases during the months from April to September. The rainfall was somewhat below the average during the early part of the summer, but it exceeded the normal in August and September. Comparing the rainfall, dryness, temperature, etc., with the reported occurrence of diseases there seems to be shown a close relationship between the occurrence of diseases and the meteorological conditions. The occurrence of fungi on various economic plants in the station grounds is briefly noted.

Channels of entrance and types of movement in bacterial diseases of plants, E. F. Smith (*Abs. in Science, n. ser., 23 (1906), No. 585, pp. 424, 425*).—A discussion is given of the various ways in which bacteria enter living plants, and some doubt is expressed as to whether certain stomatal infections may not take place through the action of drops of water standing on the plant, causing the destruction of cells underneath the epidermis. While this may account for infection through stomata, it does not remove the possibility of infection through the water pores. The various means by which the bacteria are distributed through the plants are briefly mentioned, and the author states that the transpiration stream appears to have little to do directly with the movement of bacteria in the stems of diseased plants. It appears that in some cases bacteria are able to pass from cell to cell through the pits or thin places in the cell wall without any extensive solvent action being necessary. Attention is also called to the distribution of starch in young potato tubers affected by *Bacterium solanacearum*. This organism has little diastatic action on potato starch, and the irregular distribution of the starch in affected tubers seems to indicate the paralysis or destruction of considerable areas of tissue surrounding the bacterial foci, so that it is impossible for the plant to store up the starch in such cells.

Cultures of Uredineæ in 1905, J. C. Arthur (*Jour. Mycol., 12 (1906), No. 81, pp. 11–27*).—An outline is given of culture experiments with some 30 species of rusts which have been successfully grown during 1905, particular attention being called to the plum rust (*Puccinia pruni-spinosæ*). The author investigated the possible relationship between *Æcidium punctatum* occurring on various species of Anemone, Hepatica, etc., in the United States and the rust of plums, and as a result of his investigations he arrives at the conclusion that there is no doubt of the general identity of the American and European plum and cherry rusts and their connection with *Æcidium punctatum*.

Experiments with Puccinia sorghi in 1905, W. A. Kellerman (*Jour. Mycol., 12 (1906), No. 81, pp. 9–11*).—In a previous report (E. S. R., 16, p. 787) the author gave a brief account of some experiments with the maize rust, and in the present publication a summary of previous work is included and the results of his experiments in 1905 are described.

Attention is called to the discovery of the æcidium stage on Oxalis by Dr. J. C. Arthur (E. S. R., 16, p. 986), and the author states that by using teleutospores of the maize rust he has been able to secure the æcidium on Oxalis, thus com-

pleting the demonstration of the relationship between the two different forms of the fungus. The author believes it is very probable that a few viable uredospores are carried over the winter in the teleutosporic pustules and in this case give rise to the infection of corn, and it is doubtless a fact that the rust is carried over from year to year in part by means of surviving uredospores.

The curly top or western blight of the sugar beet, C. O. TOWNSEND (*Abs. in Science, n. ser., 23 (1906), No. 585, pp. 426, 427*).—An abstract is given of a paper by the author in which there was a discussion of various theories that have been investigated as to the cause of the curly top or western blight of the sugar beet. These theories included the action of parasites, unfavorable soil, climatic, and cultural conditions, and inherent tendencies in the plant toward the disease. The bacterial theory has heretofore received more attention than others, but the results thus far seem to show that none of the organisms isolated from diseased beets is the sole cause of curly top. In some instances parasitic fungi have been found in the tissues, but inoculations made with the fungus in healthy plants in the field have not produced the disease under the conditions employed. It is believed that a combination of unfavorable conditions is necessary to produce the curly top, and the most important discovery thus far made in connection with the disease is that it does not usually attack beets in the same locality or even in the same field two years in succession.

Some diseases of beans, H. H. WHETZEL (*New York Cornell Sta. Bul. 239, pp. 197–214, figs. 16*).—This bulletin is largely compiled from previous publications of the New York State Station, the New Jersey Stations, and the Ontario Agricultural College (E. S. R., 4, p. 557; 13, p. 466; 16, p. 477). The diseases described are the anthracnose due to *Colletotrichum lindemuthianum*, bacterial blight caused by *Bacterium phaseoli*, and bean rust due to *Uromyces appendiculatus*. The nature of these diseases and methods of treatment are discussed, the author contributing a number of illustrations and notes on the life histories of the organisms.

Irish potato diseases, J. B. S. NORTON (*Maryland Sta. Bul. 108, pp. 63–72, figs. 4*).—This bulletin is based on observations by the author and also publications of the New York State Station, the Vermont Station, and this Department. The diseases described are scab, Rhizoctonia, dry rot, bacterial rot, and early and late blight, and suggestions are given for their prevention.

Spraying notes, 1904–5, E. R. BENNETT (*Connecticut Storrs Sta. Bul. 41, pp. 48–65, figs. 8*).—During the seasons 1903, 1904, and 1905, experiments were carried on with Bordeaux mixture for the prevention of late blight of potatoes, and the results obtained in the different years did not agree in all respects. In 1904 but little difference was noticed between the sprayed and unsprayed rows, but the results in 1903 and 1905 showed that on the whole spraying is very beneficial.

In 1905 the experiments were continued to ascertain the least number of applications of Bordeaux mixture that would be necessary to prevent loss from blight. With this in view, different plats were sprayed with fungicides and the check plat was sprayed with Paris green to protect it from insects. One plat was sprayed twice with Paris green, once with Paris green and Bordeaux mixture, and once with Bordeaux mixture; a second similar area was given 7 sprayings, the first and third having Paris green added to the mixture; and on still another plat 8 sprayings were given, the first 3 being of Bordeaux mixture and Paris green and the last 5 Bordeaux mixture alone. The total yields per acre from the different plats were as follows: Check plat 42.5 bu.; plat No. 2, which received 2 sprayings of Paris green and 2 of Bordeaux mixture, 180 bu.; plat 3, which received a total of 7 sprayings, 270 bu.; and plat 4, which received 8 sprayings, 315 bu. per acre.

Observations were made on the possibility of preventing discolored potatoes from rotting after digging, and it was found that where the discoloration was due to the presence of a fungus nothing could be done to stop the rot. There appears to be little indication that the disease spreads in the soil after ripening, and on this account it is recommended that potatoes rotting in the ground should be left as long as the season will permit before digging.

Notes are given on tomato spraying, in which Bordeaux mixture was applied on 9 different dates for the prevention of leaf spot, and while the treated vines remained green until frost, no data relative to the weights of fruits or yields were kept. In another series of experiments the plants were given 5 applications of Bordeaux mixture, and the yield of sprayed and unsprayed plants is shown in tabular form. In every case the yield from the sprayed plants was largely in excess of that from the unsprayed ones.

In a previous publication of the station (E. S. R., 16, p. 66) an account is given of spraying cucumbers for the prevention of blight. These experiments have been continued, and as the result of 3 years' work with Bordeaux mixture on cucurbits it is shown that there was a decided increase in yield for the first and third years, when the downy mildew was present, and a decided decrease the second year, when no fungus was troublesome on the plants. This showing raises the question as to whether it pays to spray melons and cucumbers, and in the absence of knowledge relative to the probable occurrence of disease, it would doubtless pay to spray the plants or at least to be prepared to give thorough spraying on the first appearance of disease.

Potato spraying experiments in 1905, F. C. STEWART, H. J. EUSTACE, and F. A. SIRRINE (*New York State Sta. Bul. 279, pp. 153–229, pls. 5, map 1*).—A report is given of the fourth year's experiments in potato spraying carried on by the authors in the 10-year series of experiments which have been previously described (E. S. R., 14, p. 875; 15, p. 781; 17, p. 46).

During 1905 the experiments carried on by the station at Geneva gave an increase of 119⅓ bu. per acre when the plants were given 5 sprayings and 107 bu. when given 3 sprayings. At Riverhead, on Long Island, the gain due to 5 sprayings was 82 bu. per acre and to 3 sprayings 31⅓ bu. At this place the flea beetle was the chief enemy of the potato.

In what are called the farmers' business experiments, in which potatoes were sprayed under the direction of the station officers, in 13 experiments, including 166⅔ acres, the average gain due to spraying was 46½ bu. per acre, the cost of spraying $4.25 per acre, and the average net profit $20.04 per acre. In 50 volunteer experiments, including 407 acres of potatoes, the gain due to spraying was 59½ bu. per acre, and the average net profit in 29 of the experiments was $29.85 per acre.

In comparative tests of the efficiency of soda Bordeaux and lime Bordeaux mixture the rows sprayed 4 times with lime Bordeaux yielded at the rate of 9 bu. per acre in 1 test and 35 bu. per acre in another test more than similar plats sprayed with soda Bordeaux. The addition of Paris green or arsenate of soda to Bordeaux mixture can be performed without any danger of injury where used in moderate amounts.

During 1905 in unsprayed fields the loss from blight, rot, and flea beetles was estimated at 50 bu. per acre. The experiments conducted by farmers in the past 3 years have shown net profits due to spraying of $22.79 per acre.

The authors recommend beginning spraying when the plants are 6 to 8 in. high and repeating it throughout the season at intervals of 10 to 14 days, or until 5 or 6 applications have been given the plants. When bugs are troublesome Paris green or other poison may be added.

Good results from spraying potatoes, F. H. HALL ET AL. (*New York State Sta. Bul. 279, popular ed., pp. 16*).—A popular edition of the above.

Spraying for potato blight in 1905, C. A. McCUE (*Michigan Sta. Bul. 236, pp. 131–143, figs. 2*).—After briefly describing the cause of potato blight, the author gives the results of experiments in which potatoes were sprayed with Bordeaux mixture and comparisons made with similar plats receiving a spraying of lime water. Where the potatoes were given 14 sprayings of Bordeaux mixture at intervals of 4 days a net gain of $11.90 per acre is reported. Where they were sprayed at intervals of 10 days, 6 applications being given, a net gain of $15.44 per acre is given. On plats sprayed every 15 days a net gain of $13.38 per acre is reported, and where given 4 sprayings at intervals of 20 days $11.03 per acre net gain is reported. For the plat which received 14 sprayings of lime water at intervals of 4 days a loss of $1.76 is reported. The cost of the spraying is said to have been 72 cts. per acre for each application. This amount the author believes could be reduced to not more than 55 cts. per acre.

The author gives compiled information relative to spraying by individual farmers, the results obtained at other stations, etc., and notes that the station expects to carry on experiments for the prevention of late blight for at least 5 years.

The spraying of potatoes for prevention of leaf blight and rot, E. P. SANDSTEN and J. G. MILWARD (*Wisconsin Sta. Bul. 135, pp. 24, figs. 7*).—In 1904 experiments were begun in spraying potatoes for the prevention of blight and rot and continued in 1905, the details of the experiments being described in the bulletin. In the different experiments in 1905 important gains were noted for nearly every treated lot, in some cases the gains ranging from $19.20 per acre to $36 per acre, which were made at a cost of less than $4 per acre for spraying.

The control of apple bitter rot, W. M. SCOTT (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 93, pp. 36, pls. 8, fig. 1*).—An account is given of experiments for the control of the bitter rot of apples, which is due to the fungus formerly known as *Glœosporium fructigenum*, but which has received the name *Glomerella rufomaculans*. A detailed account of the disease and the fungus has been given in a previous publication (E. S. R., 15, p. 270).

In the present bulletin the author briefly describes the fungus, and the relation of bitter-rot cankers on the branches of trees to infection, which was previously noted (E. S. R., 14, pp. 367, 581; 15, p. 270), is discussed at some length. A discussion is given of the effect of moisture and temperature on the disease, and the relative susceptibility of different varieties is commented upon.

The investigations which are reported were carried on in Nelson County, Va., in a region famous for the production of Yellow Newtown or Albemarle Pippin apples. The object of the experiment was to determine to what extent bitter rot can be controlled by spraying with Bordeaux mixture, the number of applications required, and the proper time to make the applications. The season of 1905 was so favorable to the development of bitter rot and the disease appeared so early and continued with such abundance throughout the season that the results obtained are believed to be a safe guide for almost any season.

It was found that bitter rot can be almost completely controlled by proper applications of Bordeaux mixture, 93 to 98 per cent of sound fruit having been saved by such treatment, while the fruit of the trees not sprayed rotted completely. Four applications made at the proper time are believed to be sufficient to control the disease, and these should be made at intervals of 2 weeks, beginning about 6 weeks after the trees bloom. Thorough applications of Bordeaux mixture are necessary, so that the fruit may be well coated with the fungicide.

Other diseases, such as scab, leaf spot, and sooty blotch may be controlled in

connection with the treatment for the bitter rot. For the combined treatment of apple scab and bitter rot the trees should be sprayed just before they bloom, as soon as the petals fall, a week to 10 days later, and about 6 weeks after the shedding of the petals, to be followed at intervals of 2 weeks thereafter until 7 or 8 applications have been given.

In a dry, cool season the intervals between the later sprayings may be lengthened. On the other hand, in a hot, humid season it will probably be found necessary to shorten the intervals and increase the number of applications. If the treatment for any reason should be delayed until after it is discovered that infection has taken place, the trees should be thoroughly sprayed twice in rapid succession with an interval of a few days in order to coat the fruit thoroughly as quickly as possible.

The wrapping of apple grafts and its relation to the crown-gall disease, H. von Schrenk and G. G. Hedgcock (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 100, pt. 2, pp. 12*).—In a previous publication (E. S. R., 17, p. 779) the nature and cause of crown-gall disease of apple trees and its different types are discussed, and in the present publication only 2 forms are considered, the hairy root and the crown gall. The hard and soft types of the crown gall have not yet been fully differentiated.

In the present paper an account is given of experiments in which cloth, rubber, waxed paper, plain thread, waxed thread, and plain thread with union waxed were tested to determine their effect in preventing the occurrence of crown gall by providing conditions under which a perfect union is formed between the stock and scion in the shortest possible time. A large number of grafts were made, and the detailed results are shown, from which it appears that wrapping the grafts reduced the number of crown-gall trees very materially.

The most effective wrapping, so far as the true crown gall is concerned, was that made of rubber, followed closely by cloth. The cloth wrappings, however, showed the highest percentage of smooth trees, when not only the crown gall but also the hairy root form were considered. From the results thus far obtained, the use of either cloth or rubber as a material for wrapping apple grafts is recommended, and when the question of expense is to be considered it is believed that cloth will be found more desirable, as in most cases it gives results fully as satisfactory as rubber. The writers strongly advise against the wrapping of grafts with thread and subsequently waxing the grafts.

Peach mildew, O. B. Whipple (*Colorado Sta. Bul. 107, pp. 7, figs. 2*).—According to the author, peach mildew has made its appearance in some parts of Colorado, and the purpose of the bulletin is to point out the nature of the disease and describe some of the means of combating it.

Notes on rougeot of grapes, L. Ravaz and L. Roos (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 6, pp. 366, 367*).—The authors claim that this disease is characterized by an accumulation of red coloring matter in the leaves and is produced under varying circumstances. They reject the theory that it is caused by the development of parasites within the leaves and show that it may be produced by the ringing of a branch or the severing of one of the principal veins of a leaf. That the disease is not parasitic they claim is further shown by analyses of many parts of the vines at different stages of growth. Their figures show that in the diseased vines there is a large accumulation of starch and sugar in the diseased parts and a deficiency of lime and magnesium in most parts of the affected plants.

Cranberry spraying experiments in 1905, C. L. Shear (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 100, pt. 1, pp. 8 fig. 1*).—In a previous publication (E. S. R., 17, p. 51) a brief account was given of cranberry diseases and the results of

spraying experiments with Bordeaux mixture. The results in 1904 were not entirely satisfactory and the experiments were repeated in 1905 with greater success. Applications were made of Bordeaux mixture to which was added 4½ lbs. of commercial resin-fishoil soap to 50 gals. of the solution. Different plats were sprayed at different dates during the season, and in addition to the experimental plats several acres were treated, and the results showed marked differences in the appearance of the fruit on the sprayed and unsprayed plats by the middle of summer.

In order to determine whether any injury would result from spraying plants while in bloom, one plat was sprayed while in full bloom and the fruit compared with that on adjoining plats not sprayed. No difference could be noticed in the amount of fruit on the sprayed and unsprayed plats.

In order to compare the keeping qualities of sprayed and unsprayed fruit, more than 3,000 berries were collected and placed in glass dishes in the laboratory and counted each week to determine the amount of disease which developed. On October 18, about the time the fruit from the bog was marketed, 9.8 per cent of the sprayed fruit showed diseased berries, while 38.1 per cent of the unsprayed fruit and 37.4 per cent of fruit which had been treated with a simple copper sulphate solution were decayed. In other words, four times as much of the unsprayed fruit decayed between the time of picking and marketing as of the sprayed fruit.

As a result of 3 years' spraying experiments, it is believed that by the proper use of Bordeaux mixture the loss from fungus diseases may be reduced to 10 per cent or less. As a rule the benefit is more marked in the second year than the first, and this is evident not only in the prevention of scald and rot of the fruit, but in the general improvement and productiveness of the vines.

The cost of spraying in the experiments described above averaged from $15 to $20 per acre, about 1,000 gals. of solution being applied in 5 applications.

A new disease of coffee in New Caledonia, I. Gallaud (*Compt. Rend. Acad. Sci.* [*Paris*], *141* (*1905*), *No. 22, pp. 898–900*).—The author reports the occurrence on the coffee trees of New Caledonia of the fungus *Pellicularia koleroga*. This parasite which was first described from Mysore in 1880 has since been reported from Venezuela and now from New Caledonia. In Venezuela it is said to have proved a very serious pest, and attention is called to the disease to prevent its spread if possible.

The fungus makes its appearance during the rainy season at a time when the coffee trees are most actively growing, and attacking the leaves it causes them to turn yellow, and finally the entire tree is defoliated and killed. In addition to the leaves it is found on all the aerial organs of the plant, causing by its brownish mycelium the presence of yellowish-brown patches on the leaves, fruits, etc.

The fungus seems to be a superficial one, and it is thought that probably it can be held in check by the use of fungicides without injury to the host plant. Experiments along this line are to be undertaken.

Cacao diseases, II (*Bul. Dept. Agr.* [*Jamaica*], *4* (*1906*), *No. 1, pp. 11–13*).—A description is given of a pod disease of cacao due to the fungus *Diplodia cacaoicola*, most of the information being drawn from another source (E. S. R., 13, p. 964).

A tree-strangling fungus (*Jour. Bd. Agr.* [*London*], *12* (*1906*), *No. 11, pp. 690–692, fig. 1*).—A description is given of *Thelephora laciniata*, a fungus that, while not parasitic, is more or less destructive to seedlings through its growth about the base of the stems. The fungus adheres closely to the stem, giving it

a frilled appearance, and may extend up the stem for a distance of 6 in. to a foot or more. When badly attacked the plants frequently are destroyed.

Violet root rot (*Jour. Bd. Agr. [London], 12 (1906), No. 11, pp. 667, 668, pl. 1*).—The author briefly describes the disease due to *Rhizoctonia violacea*, a fungus which attacks alfalfa, clover, carrots, beets, mangels, and potatoes. On account of the wide range of host plants, care must be exercised in rotation experiments, and injury due to the fungus may be prevented to a considerable extent by proper rotations, drainage, culture, and seed selection.

Broom rape on pelargonium, B. D. HALSTED, E. J. OWEN, and J. K. SHAW (*New Jersey Stas. Rpt. 1905, p. 509, pl. 1*).—An account is given of the attack by one of the broom rapes (*Orobanche minor*) on pelargoniums growing in the greenhouse at the station. The author also notes the occurrence of *O. ramosa* on tomato plants under the same conditions.

Spraying mixtures, W. E. BEAR (*Jour. Bd. Agr. [London], 12 (1906), No. 11, pp. 660–666*).—The author calls attention to the unsuitability of some fungicides for general use, and states that the spraying of fruit trees and bushes is at present in an empirical stage. He suggests that experiments should be carried on to put the practice on a more satisfactory basis. These would include investigations on the effective strength of solutions, importance of purity of materials, and the proper times for spraying.

A method for the determination of the fineness of sulphur used as a fungicide, C. DUSSERRE (*Ann. Agr. Suisse, 6 (1905), No. 9, pp. 383–387*).—For the rapid determination of the fineness of sulphur to be used in combating the powdery mildew of the grape the author recommends an adaptation of the Schöne soil elutriator, and gives the results of a number of tests of this apparatus, comparing the results with those obtained by other methods.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

International catalogue of scientific literature. N—Zoology (*Internat. Cat. Sci. Lit., 1905, pts. 1, pp. VIII+432; 2, pp. XI+963*).—The third annual issue of the literature on zoology is divided into 3 parts, of which the first part contains a general account of the system pursued in classifying zoological literature and an author index on literature published since 1901, but particularly for the year 1903. Part 2 contains a subject index of literature relating to invertebrate animals.

The night hawk, A. MERAZ (*Com. Par. Agr. [Mexico], Circ. 40, pp. 4, fig. 1*).—The habits of this bird are briefly discussed with particular reference to its agricultural importance. The night hawk is almost strictly insectivorous and a large proportion of the insects upon which it feeds is injurious. In an examination of 87 stomachs of night hawks, 20,000 ants were found in addition to various other insects.

Birds that eat the cotton-boll weevil, A. H. HOWELL (*U. S. Dept. Agr., Bur. Biol. Survey Bul. 25, pp. 22*).—Observations on birds in the region where the cotton-boll weevil prevailed in 1905 have added somewhat to the list of those known to feed upon this pest. At present 28 species are recorded as feeding upon the cotton-boll weevil to some extent and part of them in summer and others during the winter months. Notes are given on the importance of various birds in this work, including orioles, blackbirds, meadow lark, night hawks, sparrows, fly catchers, quail, etc. Details of observations at different points are also presented together with a tabulation of the results obtained by the examination of birds' stomachs.

Fifth report of the State entomologist, W. E. BRITTON (*Connecticut State Sta. Rpt. 1905, pt. 4, pp. XV + 189–262, pls. 12, figs. 7*).—A brief statement is

made of the organization, equipment, lectures, correspondence, and nursery inspection of the entomological department. During the year under report about 6,000 trees were sprayed for scale insects and attention was also given to tobacco insects, mosquitoes, insecticides, elm-leaf beetle, onion maggot, cutworms, San José scale, etc.

More than 6,000 pear, peach, and apple trees located in 5 towns were treated for San José scale. The spray mixtures included lime-sulphur and lime-sulphur-salt washes boiled with external heat or self-boiled and kerosene-limoid emulsion. The lime-sulphur mixture was prepared according to the formula 20–14–40. The average efficiency ranged from 88.3 to 94.9 per cent, being lowest in the case of kerosene limoid and highest after the use of a lime-sulphur and sodium-sulphid wash. The cost of the various washes ranged from 54 cts. to $1.66 per 40 gal., being lowest in the case of lime-sulphur wash and highest with the kerosene limoid. The author considers all of the mixtures as fairly satisfactory. No appreciable benefit was observed from the addition of salt to the lime-sulphur wash.

A list is presented of insects collected from the flowers of fruit trees and plants and notes are also given on mosquitoes, woolly maple scale, tussock moth, scale insects of Connecticut, gypsy moth, and Indian meal moth, as well as short paragraphs on a number of less important injurious insects. The apple maggot was found infesting huckleberries and the thistle butterfly was observed as an enemy of hollyhocks.

Report of the entomologist, E. H. SELLARDS (*Florida Sta. Rpt. 1905, pp. 17–28*).—During the year under report considerable of the entomologist's time has been taken with identification of insects and nursery inspection. The desirability of a State inspection law is urged. Considerable damage was done to potatoes by a potato maggot (*Pegomyia fusciceps*). This pest tunnels through the potato causing a destruction of its substance and leading to the development of decay. It is suggested that the use of commercial fertilizers may assist in repelling this insect. Some injury was also done to potatoes by ants which attack the stems. The common potato beetle is also reported as having at last been found in Florida. The injuries thus far done in Florida are not very serious.

Considerable attention is given to a discussion of the mosquitoes of Florida and notes are presented on white fly, cottony cushion scale, cotton stainer, and *Pachnaeus distans* which attacks the roots of the grape fruit.

Report of the entomologist, J. B. SMITH (*New Jersey Stas. Rpt. 1905, pp. 527–687, pls. 7, figs. 39*).—In combating the San José scale the author recommends that spraying be done as soon as the fruit is off and the foliage is mature in the fall. Preference is given to soluble oils as an insecticide although other kerosene mixtures and lime-sulphur-salt are also recommended. An account is presented of the efforts put forth in Newark and other cities of New Jersey in controlling shade-tree insects under the direction of commissions appointed for that purpose. Notes are also given on the oyster-shell bark-louse, elm-leaf beetle, gypsy moth, brown-tail moth, pear psylla, cornstalk borer, rose chafer, Asiatic lady bird, tussock moth, peach soft scale, cottony maple scale, and other injurious insects.

During the season successful experiments were carried out with a lime-sulphur-caustic-soda mixture applied in the first week of April for destroying San José scale. A brief summary is also presented of entomology in the crop bulletin and on observations made in the experimental orchard of the station. In experiments on cranberry insects it appeared that *Eudemis vacciniana* may be partly destroyed in the egg stage by flooding the cranberry beds for 2 weeks

under 18 in. or more of water at a temperature of 60° F. Reflooding of the beds for 24 hours after the eggs have hatched will destroy nearly all of the larvæ. It appears that the natural enemies of the cottony maple scale may be largely depended upon to control this pest. Brief notes are given on the results of practical tests with a number of proprietary insecticides.

A report is given on the mosquito investigation during 1905 (pp. 655–689). In this work particular attention was given to determining the beneficial results from previous drainage work and other remedial measures and a further survey of the study to determine the work still to be done. Estimates are given of the cost of operations which will be carried on in utilizing the State appropriations for mosquito work.

Report of the government entomologist, C. FULLER (*Natal Dept. Agr., Rpt. Govt. Ent., 4 (1903–4), pp. 47, pls. 8, figs. 3*).—A general account is given of the routine work of the office with notes on lectures given by the entomologist and travel done in various parts of the colony. An unknown species of Carpocapsa is referred to under the name of Natal codling moth and brief notes are given on its habits. It attacks peaches, Chinese guavas, oranges, and mandarins. The pest may be partly controlled by removing infested fruits, but spraying with Paris green combined with Bordeaux mixture is also of great value. An account is also given of the true codling moth, fig curculio (*Metatyges turritus*), mango weevil, *Bengalia depressa* which attacks man, dogs, rabbits, and other animals; Mediterranean fruit fly, mosquitoes, *Bagrada hilaris*, scale insects, locusts, rhubarb blight, English sparrow, and various other pests. Formulas are also presented for the preparation of certain insecticides.

Report of the government entomologist, C. FULLER (*Natal Dept. Agr., Rpt. Govt. Ent., 5 (1904–5), pp. 17, pl. 1*).—The routine inspection and other work of the office for the year is briefly described. A statement is also given regarding the investigation of fruit fly parasite. It is believed that the parasite which has been found in Brazil does not promise to be of much assistance in the control of the fruit fly. Copies are also given of certain legislation relating to plant diseases, cotton diseases, weeds, fruit inspection, etc. During the year under report arsenical insecticides were extensively used in the control of locusts, and this work gave good results.

Entomological division, W. R. DEWAR (*Orange River Colony, Dept. Agr., Ann. Rpt., 1 (1904–5), pp. 183–238, figs. 10*).—The matters discussed in this report include the use of arsenicals and other methods for combating locusts, the inspection of nursery stock so as to prevent the introduction of injurious insects, the distribution of lady beetles, the investigation of mosquitoes and ticks, as well as a large variety of insects injurious to garden and field crops. A brief account of birds as related to agriculture is given by C. M. Johnston (pp. 221–228), and the subject of injurious weeds is also discussed (pp. 229–238).

The entomological section, C. B. SIMPSON (*Transvaal Agr. Jour., 4 (1906), No. 15, pp. 619–626, pls. 4*).—*Ophiusa catella* is injurious during its larval stage to the leaves of castor-oil beans while the adults puncture peaches, thereby greatly injuring the crop. Notes are given on the insect in its various stages and on its natural enemies. In small plantations of castor-oil beans handpicking is quite satisfactory, while on large plantations spraying is necessary, and for this purpose Paris green or some other arsenical is recommended. Notes are also given on *Heliocopris hamadryas* and the cigarette beetle.

Report on injurious insects in Finland, E. REUTER (*Landtbr. Styr. Meddel., 50, 1905, pp. 27*).—The year under report was unusually cloudy and cold and therefore somewhat unfavorable to the multiplication of insects. As in previous reports, the author classifies his discussion of injurious insects according to the plants affected. Grasses of pastures and meadows were injured to some extent

by *Charæas graminis* and a number of other insects which produce blasting of the heads. The larvæ of crane flies were also observed in considerable numbers. Brief notes are given on wireworms, snails, fruit fly, and other enemies of cereals. Among the garden pests the cabbage and beet-root maggots deserve special mention. Potato scab also prevails quite widely. The life history and habits of *Uropoda obnoxia* are described. The most injurious insects on fruit trees during the year were codling moth, *Argyresthia conjugella*, gipsy moth, and pear-leaf blister-mite. In combating the gypsy moth, lead arsenate was used with good results. Brief notes are also given on insects injurious to trees and ornamental plants.

Entomological notes, J. Kotinsky (*Hawaii. Forester and Agr., 2 (1905), No. 10, pp. 295–299*).—*Siphanta acuta* is found in large numbers on coffee and is believed to assist in the distribution of the brown eye-spot disease of coffee. Notes are given on a parasite of the egg of this pest and on *Scutellista cyanea* and fleas in relation to the distribution of the disease.

Annual report for 1905 of the zoologist, C. Warburton (*Jour. Roy. Agr. Soc. England, 66 (1905), pp. 178–191, figs. 2*).—The bud mite of the currant still continues to occupy considerable attention. The author believes that there is no likelihood of exterminating the pest except by destroying infested bushes. Notes are given on the habits, life history, and means of combating *Chermes laricis*, asparagus beetle, *Hadena pisi*, *Siphonophora fodiens*, various species of Tarsonemus, and other injurious insects.

The monthly bulletin of the division of zoology, H. A. Surface (*Penn. Dept. Agr., Mo. Bul. Div. Zool., 3 (1906), No. 12, pp. 367–404, pls. 2*).—Good results are reported from the use of poisoned bran in destroying cutworms. An announcement is made regarding the forthcoming brood of 17-year locusts. Notes are also given on the present distribution and injuries caused by San José scale. The value of sulphur for insecticide purposes is briefly discussed with notes on the process of manufacturing it and the various qualities of sulphur which may be obtained. Notes are also given on the dates of last killing spring frosts in Pennsylvania for a number of years, fumigating houses for fleas, and other subjects.

The monthly bulletin of the division of zoology, H. A. Surface (*Penn. Dept. Agr., Mo. Bul. Div. Zool., 4 (1906), No. 1, pp. 40, figs. 2*).—In experiments with the asparagus beetle it is found that this pest may be controlled in large part by the application of arsenicals, such as Paris green and arsenate of lead, but that such applications should not be made too soon before the asparagus is cut for food. The preparation recommended by the author includes 2 oz. of lead arsenate and 5 oz. of resin soap in 3 gal. of water. Formulas are also given for various fungicides and insecticides, together with notes on methods for controlling some of the more important insect pests.

National control of introduced insect pests, E. D. Sanderson (*Pop. Sci. Mo., 68 (1906), No. 5, pp. 431–439*).—The questions raised by the great damages caused by the boll weevil, gypsy moth, and brown-tail moth are discussed with particular reference to the interference of the National Government in the control of these pests. The case is believed to be analogous to those in which, for the purpose of protecting human health against various plagues, the Federal Government has felt called upon to interfere. Various instances are cited in which this Department has taken a hand in the suppression of animal plagues, particularly the recent outbreak of foot-and-mouth disease in New England.

Catalogue of recently described coccidæ, J. G. Sanders (*U. S. Dept. Agr., Bur. Ent. Bul. 12, tech. ser., pt. 1, pp. 18*).—Several additions to the species of Coccidæ have been made since the publication of Mrs. Fernald's catalogue in

Massachusetts Station Bulletin 88 and are here arranged under 9 genera, 137 species, and 22 varieties.

Formalin as a reagent in the preparation of some soft-bodied Coccidæ, E. E. GREEN (*Ent. Mo. Mag., 2. ser., 17 (1906), No. 198, pp. 129, 130*).—Some difficulty has been experienced in preserving Coccidæ, especially the soft-bodied species, for subsequent study. The chitin of the skin often fails to hold its form, and the dermal cells and other characteristic features may become obliterated. The author accidently discovered that formalin in a 3 per cent solution preserves these features in excellent condition.

The bionomics of grain weevils, F. J. COLE (*Jour. Econ. Biol., 1 (1906), No. 2, pp. 63–71*).—The experiments reported in the present paper were made on the common grain and rice weevils. It appears that moisture under a temperature of 80° F. is favorable to the life of adult grain weevils but that the temperature of 80° F. without the moisture is quite fatal to the beetles. A nonventilated atmosphere at a temperature of 80° F. charged with water vapor furnishes favorable conditions for the life of the beetles. Experiments in withholding oxygen from the beetles indicate that they may thrive well in an atmosphere containing 80 per cent of carbon dioxid. It is obviously impossible therefore to destroy them by preventing ventilation.

Animals injurious to sugar beets, J. JABLONOWSKI (*A czukorrépa állati ellenségei. Budapest: Hungarian Sugar Beet Assoc., 1906, pp. 288, figs. 65*).—The sugar beet industry of Hungary is of sufficient importance to justify an elaborate study of the insect enemies of this plant. The author has made observations on the important insect enemies of sugar beets, and in the present volume presents the results of his study, together with the results of other investigators who have worked along the same line. The insects discussed in the volume include a long list of species injurious to the various parts of the sugar beet. Myriapods, mites, and related species of animals are discussed. Among the more important insects mention may be made of *Cleonus punctiventris*, *C. pedestris*, *Haltica oleracea*, various species of wireworms, *Aphis papaveris*, caterpillars injurious to leaves, especially webworms, *Pegomyia hyoscyami*, related species of maggots, etc.

Insect pests of cotton in India, H. MAXWELL-LEFROY (*Agr. Jour. India, 1 (1906), No. 1, pp. 49–61, pls. 4*).—On account of the large annual production of cotton in India the insect pests of this crop assume considerable economic importance. In the present article particular attention was given to cotton aphis, *Dysdercus cingulatus*, bollworms (*Gelechia gossypiella*, *Earias fabia*, and *E. insulana*), cotton-stem borer, and cotton-stem weevil. These pests are considered the most important ones affecting cotton in India, and it is estimated that they cause the destruction of about one-tenth of the crop. Fortunately the remedies for these pests are comparatively simple, and the main problem in the control of the insects consists in educating the natives of India so that they will recognize the nature of the pests and the necessity for taking some insecticide measures.

The principal insects attacking the cocoanut palm, II. C. S. BANKS (*Philippine Jour. Sci., 1 (1906), No. 3, pp. 211–228, pls. 10*).—In the present paper the author discusses certain species of lepidoptera and coccidæ which attack the cocoanut palm. In this account particular attention is given to *Thosea cinereamarginata*, *Padraona chrysozona*, *Aspidiotus destructor*, etc. It is suggested that spraying with lime-sulphur wash or kerosene emulsion would serve to protect young cocoanut trees against attacks of scale insects.

Moth borer in sugar cane, maize, and sorghum in western India, H. MAXWELL-LEFROY (*Agr. Jour. India, 1 (1906), No. 2, pp. 97–114, pls. 2*).—A number of insects are commonly referred to as moth borers of the sugar cane, but the

one which is the most injurious in western India and which is discussed in the present article is *Chilo simplex*. This species is quite closely related to *C. auricilia*, which attacks sugar cane in Bengal. The life history of the sugar-cane moth borer is described in detail. The moths fly at night and hide among the leaves or rubbish during the day. Cane, maize, and sorghum are the principal plants attacked by the pest. In the cane the insect is injurious chiefly during the young stage of the plant before the joints are formed. All parts of corn are attacked, including the cob, and sorghum is injured in all its stages. The eggs of the moth borer are parasitized to some extent, but artificial remedies must be adopted in combating it. The species seems to be generally distributed throughout India. Not all of the remedies recommended for sugar-cane borers in various parts of the world are applicable to this pest. The two best suited for controlling it are the destruction of young cane tops as soon as it is noticed that they are infested and the use of corn and sorghum for trap crops.

The melon fly, D. L. Van Dine (*Hawaii. Forester and Agr., 3 (1906), No. 4, pp. 127–129*).—*Dacus cucurbitæ* attacks all of the common cucurbits as well as string beans, tomatoes, mangoes, and papaya. Notes are given on the life history of the pest. The insect attacks the vines as well as the fruit and causes a rapid decay especially in wet weather. All infested melons and vines should be collected regularly during the season and burned or otherwise destroyed, and no such material should be left in the field after harvesting. The insects may also be prevented from doing damage to the growing crop by covering young melons with paper, straw, or a piece of gunny sack.

Codling moth parasites, W. W. Froggatt (*Agr. Gaz. N. S. Wales, 17 (1906), No. 4, pp. 387–395*).—Attention is called to the fact that the codling moth has long been known to be an important enemy of the apple and that many of its parasites must have had their present habits for hundreds of years. Detailed notes are given on some of the more important parasites of codling moth, including *Trichogramma pretiosa*, *Goniozus antipodum*, *Ephialtes carbonarius*, and species of Parisemus and Pteromalus.

The Brazil fruit fly parasites, C. P. Lounsbury (*Agr. Jour. Cape Good Hope, 28 (1906), No. 4, pp. 538–540*).—The author requested Professor Hempel of the Agronomic Institute of São Paulo to carry on further observations regarding the value of the fruit fly parasite found in that region. According to the latest report of Professor Hempel, it appears that there is no hope of obtaining any efficient help in controlling the fruit fly by the use of this parasite.

The grape curculio, F. E. Brooks (*West Virginia Sta. Bul. 100, pp. 211–249, pls. 8*).—Two insects quite commonly feed on the fruit of the grape in West Virginia. These are the grape-berry moth and the grape curculio (*Craponius inæqualis*). The grape curculio has received little attention from entomologists and was, therefore, made the subject of a continued study by the author for a long period. A circular letter of inquiry sent out to various vineyardists elicited the information that the grape curculio is quite widely distributed throughout the State and does considerable injury. The curculio is a native insect and appears to have fed on wild grapes for centuries. The grape curculio is described in its various stages and notes are given on its life history. The eggs are laid in punctures made in the fruit and hatch within 4 to 6 days, after which the larva feeds upon the fruit, leaving it later for pupation. The pupa may be found in various locations, especially just under the surface of the ground.

This insect appears to feed only on the grape. It winters over in the adult form and the hibernated beetles appear during the last of May. Apparently there is no connection between the injury from this insect and grape rot. Some

little difference is observed in the extent to which different varieties of grapes are attacked. The grape curculio is preyed upon by a number of insect enemies. Among the various methods which may be adopted in controlling this pest, spraying is of chief importance. It appears to be possible by means of arsenical sprays to control the pest quite completely. For this purpose 4 oz. of Paris green and 4 lbs. of lime in 50 gal. of water are quite satisfactory. Grapes may also be protected by surrounding each cluster with a paper bag. If this method of combating the pest is adopted it may be estimated that pins will cost 15 cts. a thousand, bags 85 cts. per thousand, and the work about $1 per thousand bunches. This method not only has the advantage of protecting grape clusters against the curculio, but also prevents rot, and the grapes have a fine appearance. It is recommended for home vineyards and commercial growers who cater to a fancy trade. The insects may also be controlled to some extent by jarring and by collecting infected grapes. A brief bibliography relating to this insect is appended to the bulletin.

Arsenical treatment of grape flea beetles, L. TRABUT (*Bul. Agr. Algérie et Tunisie, 12 (1906), No. 6, pp. 112–114*).—Some difficulty has been experienced in the use of ordinary arsenicals for destroying this pest since the grape foliage is injured by applications strong enough to destroy the insects. Within recent years, however, better results have been obtained from the use of lead arsenate since this material is almost equally poisonous to the insects and not soluble and therefore not injurious to the grape foliage.

The Bombay locust (Acridium succinctum), H. MAXWELL-LEFROY (*Mem. Dept. Agr. India, Ent. Ser., 1 (1906), No. 1, pp. 112, pls. 13*).—The present account contains a report of investigations on *Acridium succinctum* in India during the years 1903–4. In various parts of the Bombay Presidency this locust prevails in large numbers where it feeds on grasses, sorghum, and various other crops. In some cases the migratory locust (*A. peregrinum*) appeared after the other species had left. The winged locust appears during October, undertakes migration during November, remains largely in forests from December until March 20, shows other migratory movements from March 20 to May 20, after which they become scattered. The life history of the insect is discussed in detail. In combating this species, various remedies have been tried, including the use of arsenical poisons. Experiments were carried on by G. K. Walker in which the effect of eating forage plants treated with arsenicals was tested on cattle. In some instances unfavorable results were obtained, since arsenic taken repeatedly in small doses exercises a cumulative poisonous effect. The general programme of eradication of locusts as recommended by the author includes a study of the movements of the swarms during the first migrating period, driving the locusts out of crops and destroying them, particularly at night and at the time when the young hoppers first appear.

A hopperdozer, P. K. BLINN (*Colorado Sta. Bul. 112, pp. 8, figs 5*).—During recent years alfalfa has been greatly injured by grasshoppers in various parts of Colorado, and for the last few years these pests have apparently been increasing in numbers. Last year the injury from grasshoppers was unusually severe. Various methods were adopted, such as driving and the use of poisonous baits, but without much success. Experiments were carried out by the author in a number of localities during which a hopperdozer costing about $4.50 for construction was tested to determine its value when hauled over the field behind the mowing machine. It was found that 1 horse could be attached to the side in such a manner as not to frighten the grasshoppers away from the hopperdozer. The hopperdozer was mounted on wheels in order not to catch in the hay. The use of this machine on a 6-acre field of alfalfa resulted in catching between

9 and 10 bu. of grasshoppers estimated at the rate of 30,000 grasshoppers per bushel. In one instance on another field success was had in using the hopper-dozer without any oil film on the water. The grasshoppers fell into the water, from which they were unable to escape for several minutes. At the end of each round they could be collected and placed in a can, after which they were used for poultry food.

A new book and leather pest, J. Kotinsky (*Hawaii. Forester and Agr., 3 (1906), No. 4, pp. 117, 118*).—*Catorama mexicana* has been found in leather goods and books in Kona and on the island of Kauai. This pest may best be prevented by extreme cleanliness, frequent dusting and moving of books and leather goods, or if these preventive means fail, resort may be had to fumigation with bisulphid of carbon.

Note on the deposition of the eggs and larvæ of Œstrus ovis, W. E. Collinge (*Jour. Econ. Biol., 1 (1906), No. 2, pp. 72, 73*).—Some controversy has prevailed in regard to the question whether sheep botflies deposit eggs or living larvæ in the nostrils of the sheep. According to the author's observations this depends somewhat on the weather. When conditions are favorable the fly deposits eggs, but if the weather is such that the females must remain inactive for some days the eggs may hatch within the body before being deposited.

On the life history of the ox warble flies Hypoderma bovis and H. lineata, A. D. Imms (*Jour. Econ. Biol., 1 (1906), No. 2, pp. 74–89*).—The habits and life history of these insects are discussed in detail and a brief bibliography of the subject is also given. According to the author's observations it is practically impossible to decide at the present time in favor of any one of the three current theories in regard to the life history of *Hypoderma bovis*. It may be that the larvæ, immediately after hatching, eat their way through the hide and remain in the subcutaneous tissues until they are fully grown. On the other hand, the larvæ may wander extensively through the tissues of the host, even entering the spinal canal, and may then return to the subcutaneous tissues where they reach maturity. Again the larvæ may be taken into the esophagus from which they bore through the tissues and reach the skin. The usual remedies recommended for these pests are described.

The rôle played by biting flies in the spread of trypanosomiasis, J. D. E. Holmes (*Jour. Trop. Vet. Sci., 1 (1906) No. 2, pp. 119–126*).—The author calls attention to the fact that the idea that flies and other biting or blood-sucking insects act as carriers of disease is as old as the art of medicine, and that it is more difficult to reject than to accept it. Evidence is presented, however, on the basis of 3 years' observations and experiments tending to show that the rôle of biting insects in the transmission of trypanosomiasis in horses has been at least greatly exaggerated. During a period of 3 years infected ponies were kept in contact with healthy ponies in a stable where various species of horse flies were very numerous. The author frequently observed these flies sucking blood from an infected pony and later attacking healthy ponies. A number of the flies were examined and the horse blood in them was found to contain the organism of the disease. In no case, however, was the disease transmitted from an infected to a healthy animal. Other evidence along the same line is presented. The author believes, therefore, that "the theory that biting flies directly transmit the disease in cases of natural infection looks less probable and less worthy of consideration from a practical standpoint."

The anatomy and physiology of the tsetse fly, F. Stuhlmann (*Pflanzer, 1905, Nos. 24, pp. 369–384; 25, pp. 385–412*).—The observations of the author were chiefly confined to *Glossina fusca*, *G. tachinoides*, and *G. palpalis*. Detailed anatomical descriptions are given of the mouth parts, salivary glands, alimen-

tary tract, the digestive processes, and other physiological functions of these insects. An analytical table was presented for the identification of species of the genus Glossina.

The action of Aspergillus niger and A. glaucus on the larvæ of Culex and Anopheles, B. GALLI-VALERIO and JEANNE ROCHAZ-DE-JONGH (*Centbl. Bakt. [etc.], 1. Abt., Orig., 40 (1906), No. 5, pp. 630–633*).—The authors carried on experiments with mosquito larvæ in glass vessels in which spore-bearing cultures of *Aspergillus niger* and *A. glaucus* were mixed with the water. The larvæ became infected with the spores of these molds and the infection persisted into the pupal and adult stages. An attempt was made to experiment along the same line under field conditions, but the results were not satisfactory for the reason that it was found very difficult to observe the effect of the molds with certainty. Apparently the method is not practical under field conditions.

Bordeaux mixture and Paris green, F. SHERMAN, Jr., and R. S. WOGLUM (*N. C. Dept. Agr. Ent. Circ. 17, pp. 14, figs. 2*).—On account of the effectiveness and general applicability of the combination of Paris green with Bordeaux mixture in fighting both insect and fungus diseases, the authors have prepared an account of this mixture with notes on the formula, method of preparation, use, and applicability in treating the insect and fungus enemies of fruits and garden crops.

Annual report of the Beekeepers' Association of the Province of Ontario, 1905 (*Ann. Rpt. Beekeepers' Assoc. Ontario, 1905, pp. 72*).—This report contains an account of the proceedings of the twenty-sixth annual meeting of the Ontario Beekeepers' Association held in Toronto, November 15–17, 1905. At this meeting a considerable list of papers were read and were followed by interesting discussions. In the president's address, H. G. Sibbald called attention to the advantages of beekeepers from attending such meetings and exchanging views on the various problems of beekeeping.

F. C. Harrison also discussed the methods of diffusing apicultural knowledge (pp. 8–10). It was urged that bee journals should contain every month advice to beginners regarding the common troubles which they are likely to meet with in caring for bees.

R. H. Smith called attention to the necessity of systematic advertising in the successful marketing of honey (pp. 16–18). Complaint is frequently made that the demand for pure comb honey is not sufficiently active. It was suggested that this is partly due to a lack of judicious advertising on the part of bee raisers and carelessness in the packing and marketing of the product.

F. T. Shutt reported a number of experiments in apicultural work (pp. 23–26). Honey consumers sometimes complain of the granulation of honey and believe that this indicates some impurity. Attention was called to the fact that pure honey will granulate or candy even if it is maintained in cold storage at a temperature of 40° F. A large number of chemicals were tested in attempts to devise a successful method for bleaching wax. No good results were obtained. Brief notes were also given on the nature of honeydew on trees.

The report also contains short articles on Production of Comb Honey, by R. Lowey (pp. 26–28); Amendments to the Foal Brood Act, by F. J. Miller (pp. 30–33); A Method of Preventing Swarming, by J. Fixter (pp. 39–41); Beekeeping in Canada and Jamaica, by A. Laing (pp. 49–53); Out Apiaries, by D. Nolan (pp. 61, 62); and other notes and discussions.

Note on bacteria pathogenic to the silkworm, S. SAWAMURA (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, p. 106*).—In a study of flacherie of silkworms the author finds that the disease may be caused by a number of bacteria,

including various species of Proteus, *Micrococcus pyogenes aureus*, *Bacillus coli*, *B. ellenbachi*, *B. ferrugenus*, *B. fuchsinus*, *B. megatherium*, *B. megatherium bombycis*, *B. mycoides*, *B. pyocyaneus*, *B. rubefaciens*, and *B. viridans*.

FOODS—HUMAN NUTRITION.

Cooking quality of potatoes (*Jour. Bd. Agr.* [*London*], *13* (*1906*), *No. 1*, *pp. 47–49*).—Experiments on the cooking quality of potatoes, by which is meant the appearance, texture, and flavor after cooking, carried on at the Edinburgh and East of Scotland Agricultural College, are briefly summarized.

Of the different varieties Langworthy is classed as excellent; Twentieth Century, White Blossom, and British Queen as very good, and Pink Blossom, Factor, Up-to-Date, and King Edward VII as good.

"The varieties in the group classed good are at least equal to Up-to-Date in quality, and some of them surpass it. Quality in potatoes, of course, will vary considerably with soil and cultivation. On some farms the varieties classed here as good would be very good indeed, while on others they would be no more than tolerable. Their defect is a slight tendency to softness in the heart. The three heaviest cropping varieties fall into this group.

"All the varieties styled very good were very satisfactory as regards quality, but when broken they fall short of the firm flaky texture which is characteristic of the Langworthy, and which, along with fine flavor, entitles this variety to be ranked as excellent."

The cooking of starches in cereals, GRACE P. MULBERRY (*Ill. Agr.*, *10* (*1906*), *No. 7*, *pp. 238*, *239*).—A brief summary of investigations on the effect of different methods of cooking upon the quality and flavor of cereal breakfast foods. In general, the experiments showed that in order to soften the cellulose and gain the maximum flavor and palatability cooking should be continued for a considerable time (5 hours in the experiments reported). A more economical method is to cook the cereals for at least 2 hours on the day before they are required, cover the top with water to prevent drying, and allow them to stand over night. In the morning the breakfast cereal may be warmed in a double boiler "and does not of necessity become lumpy or mushy if stirred with a fork. The richness in flavor and the softness of the cellulose will well repay one for cooking cereals for 2 hours or more."

Preservation of foods on a commercial scale, X. ROCQUES (*Les industries de la conservation des aliments. Paris: Gauthier-Villars, 1906, pp. XII + 506, figs. 112*).—An extended discussion from an historical and commercial standpoint of preserving food by heat, cold, drying, and by the use of antiseptics. A special chapter is devoted to the preservation of eggs. The volume as a whole constitutes a handbook of the preserving industry. There are prefaces by P. Brouardel and A. Muntz.

A practical guide to cookery in West Africa and the Tropics, ADELAIDE M. COCKBURN (*London: Scientific Press, Ltd.*, [*1905*], *pp. XII+160*).—On the basis of experience the author gives direction for the preparation of a large number of dishes suitable for the Tropics, having in mind the available food supply. The volume contains considerable information regarding meats, vegetables, fruits, etc., found in the West African markets.

Food analyses, C. F. JURITZ (*Rpt. Senior Anal. Cape Good Hope, 1904, pp. 6–24, dgm. 1*).—Under the Food Adulteration Act a number of samples of milk, wine, and spirits, vinegar, cream, drugs, etc., were examined. In preserved egg yolk put up in bottles large amounts of boric acid were found. A partial analysis is quoted of Cape Bush tea (*Cyclopia genistoides*), a material frequently

used in the rural regions of Cape Colony for the preparation of an infused beverage. The material contained neither alkaloids nor glucosids.

Adulteration of food, W. J. GERALD (*Rpt. Inland Rev. Canada, 1905, pt. 3, pp. 101*).—Data regarding the inspection of foods, drugs, and fertilizers by Dominion chemists are summarized.

Of 75 samples of ground mustard 8 were genuine, 11 doubtful, and the remainder adulterated. None of the flours examined were adulterated. Of 18 samples of bread 2 were doubtful and 5 gave decided reaction for alum. Of 45 samples of molasses 1 was adulterated and 5 considered doubtful.

Other analyses reported in detail in appendixes have been published in bulletins of the Laboratory of the Inland Revenue Department, Ottawa, and previously noted.

Elements of applied microscopy, C. E. A. WINSLOW (*New York: John Wiley & Sons; London: Chapman & Hall, Ltd., 1906, pp. XII+183, figs. 60; rev. in Amer. Jour. Pharm., 78 (1906), No. 5, p. 238*).—This is an introductory textbook which takes up among other questions the microscopy of common starches, and foods and drugs and their adulterants.

The testing of yeast employed in bread making (*Pure Products, 2 (1906), Nos. 4, pp. 187–190; 5, pp. 226–230*).—Differences between brewers' yeast and compressed yeast are pointed out. The compressed yeast consists of the so-called top fermentation yeasts with water removed, so that the yeast may be conveniently shipped and stored. It is stated that the chief trouble arising in bread making from the use of brewers' yeast is due to the almost entire absence of diastatic enzyms and to the larger proportion of trypsin which it secretes. The trypsin causes cleavage of proteids, and so the glutenin of the dough becomes softened to such an extent that it fails to retain carbon dioxid. When compressed yeast is used the glutenin remains tough and retains gas. In testing compressed yeast such characteristics as color, odor, taste, and keeping quality should be taken into account. The yeast should also be examined for adulteration with bottom-fermenting brewers' yeast, and methods of making the tests are pointed out. The fermenting power should also be determined, and the Hayduck method is considered most satisfactory for the purpose.

The decomposition of French mustard by bacteria and its prevention, A. KOSSOWICZ (*Ztschr. Landw. Versuchsw. Oesterr., 9 (1906), No. 3, pp. 111–116, pl. 1*).—Two forms of bacteria were isolated which were regarded as the main cause of decomposition of bottled mixed mustard. Other changes were attributed to mechanical and chemical causes; for instance the separation of the liquid from the solid portion and the rancidity of mustard fats. Sterilization of the bottled mustard is recommended as a preventive, as well as the use of well stoppered bottles and mixing the mustard with 4 or 5 per cent vinegar and allowing it to stand 12 hours before bottling.

A study of three vegetarian diets, D. N. PATON and J. C. DUNLOP (*Proc. Roy. Soc. Edinb., 25 (1904–5), pt. 7, pp. 498–506*).—Two of the 3 dietaries studied included milk and eggs as well as vegetable foods, while the third was made up entirely of bananas. The subject of the fruitarian dietary, a man weighing 52 kg., consumed during the 5 days he was under observation 9 lbs. 8 oz. of this fruit. The food value of the diet was only 7.5 gm. protein, 0.7 gm. fat, and 199.8 gm. carbohydrates per day with a fuel value of 856 calories. During the entire period considerably more nitrogen was excreted than was consumed, the amount being equivalent to a daily loss of 19.8 gm. of tissue protein, or about 100 gm. of flesh. These values are very similar to those noted in starvation. The total amount of nonurea nitrogen was less than normal and the preformed ammonia was very small.

In the other 2 diets the amount of protein and energy was sufficient for the maintenance of health and muscular vigor, but the cost was considerably in excess of "that for which the laboring classes in town or country are able to procure an equally satisfactory diet."

"The study of the ordinary diets of the laboring classes in all countries seems to show that whenever possible a diet is secured which will yield something over 3,000 calories of energy and over 100 gm. of proteids per man per diem. It is improbable that so many different races should have made the same mistakes in the essential elements of their very varied diets."

Results of digestion experiments with milk powder, F. Krull (*Milchw. Zentbl., 2 (1906), No. 4, pp. 165–173*).—A summary of analytical data and the results of artificial and natural digestion experiments led the author to conclude that milk powder is readily and thoroughly digested and may be used in infant feeding and in the household in many ways.

Nitrogenous metabolism in normal individuals, J. M. Hamill and S. B. Schryver (*Jour. Physiol., 34 (1906), No. 3, Proc. Physiol. Soc., 1906, pp. X–XII*).—Six-day experiments with 7 subjects showed that on an average the nitrogen excreted per day was 13.5 gm. Allowing for a loss of 10 per cent in the feces, this is equivalent to 93 gm. of protein per person per day. The ratio of uric-acid nitrogen to total nitrogen was fairly constant, being 1.54 on an average.

Carbohydrate combustion in the animal body, J. Stoklasa (*Ber. Deut. Chem. Gesell., 38 (1905), No. 2, pp. 664–670*).—Studies of the effect of expressed meat juice on carbohydrates led to the conclusion that the energy-yielding processes in cell protoplasm are brought about by the enzym lactolase which forms lactic acid from carbohydrates, and by alcoholase, which forms alcohol and carbon dioxid. The secondary products which are formed by further cleavage are produced only when oygen is present. The enzyms which cause such cleavage are acetolase and formilase. The cleavage products capable of oxidation are converted into carbon dioxid and water by the oxygen of the air.

The chemistry of digestion in the animal body. III, Proteid cleavage in the digestive tract, E. S. London (*Ztschr. Physiol. Chem., 47 (1906), No. 4–6, pp. 368–375*).—In the middle portion of the small intestine alanin and aspartic acid were noted as cleavage products in addition to those reported by other observers when meat was fed. The experiments were made with dogs. The author believes that it is possible to determine proteid cleavage quantitatively in the animal body, and that Fischer's ester methods may be used with good results in studying products of animal digestion.

Concerning the extractive material of muscular tissue. III, Methylguanidin, W. Gulewitsch (*Ztschr. Physiol. Chem., 47 (1906), No. 4–6, pp. 471–475*).—Methylguanidin, a constituent of meat extract, the author concludes is formed by autolysis either after death or, more probably, during life and is to be regarded as an oxidation product of creatin or creatinin. For earlier work see E. S. R., 17, p. 683.

Protein assimilation in the animal body, E. Abderhalden and P. Rona (*Ztschr. Physiol. Chem., 47 (1906), No. 4–6, pp. 397–403*).—When the body is supplied with a large excess of protein the authors conclude, from their experiments, that it has the power to select those which are best suited for the formation of body proteids. The experiments were made with dogs, and the balance of income and outgo of nitrogen was determined.

A law of growth reiterated, G. Lusk (*Amer. Jour. Physiol., 15 (1906), No. 3, Proc. Amer. Physiol. Soc., 18 (1905), pp. XVII, XVIII*).—The law which the author formulates is that in the normal development of young of the same age and species a definite percentage of the energy content of the food is required for growth irrespective of the size of the individual.

Demands for heat and the calorimetric value of a ration with respect to temperature or climate, J. Lefèvre (*Compt. Rend. Soc. Biol.* [*Paris*], *60* (*1906*), *No. 15, pp. 750–753*).—Using a special form of calorimeter, which he has elaborated, the author measured the heat output of the body at temperatures ranging from −1 to +20° C. The results, which included the calculated latent heat of excreted water vapor, ranged from 1,900 calories at the higher temperature to 5,400 calories at the lower temperature per 24 hours for a man wearing medium-weight clothing. This indicates, in the author's opinion, the need of more energy in the diet in winter than in summer.

The body's utilization of fat, F. S. Mathews (*Pop. Sci. Mo., 68* (*1906*), *No. 5, pp. 425–430*).—Modern views regarding the formation and utilization functions of fat, obesity and fat formation, etc., are summarized.

According to the author, "the question of the amount of fat in any individual is a very complex one, depending on such a variety of factors as condition of digestion, appetite, character and quantity of food, amount of exercise, and the proper working of a number of body glands."

The right method of eating and the evils of eating too rapidly or too slowly, M. Einhorn (*Ztschr. Diätet. u. Phys. Ther., vol. 8, p. 622; abs. in Hyg. Rundschau, 16* (*1906*), *No. 9, pp. 501, 502*).—The author believes that harmful results attend eating either too rapidly or too slowly. In the former case serious digestive disturbances may be induced, while the latter may cause mental depression which leads to chronic inanition.

Vegetable products in feces, F. Netolitzky (*Die Vegetabilien in den Fäces. Vienna: Moritz Perles, 1906, pp. 100, figs. 39; rev. in Ztschr. Untersuch. Nahr. u. Genussmtl., 11* (*1906*), *No. 6, p. 376*).—The identification in the feces of residues of vegetable origin by means of the microscope is described.

ANIMAL PRODUCTION.

The nutritive value of several kinds of hay, F. Tangl and S. Weiser (*Landw. Jahrb., 35* (*1906*), *No. 1–2, pp. 159–223*).—The digestibility and nutritive value of ordinary hay, hay from irrigated meadows and moors, Alpine hay, alfalfa hay, and sour hay were studied, the digestion experiments being made with horses, steers, and sheep.

Taking into account the energy value of the food, urine, feces, and the estimated energy value of the methan excreted, the authors calculated the physiological nutritive value—that is, the energy value of the food less the energy value of the excretory products.

The authors point out that the experiments furnish a demonstration of the belief that horses digest their food less thoroughly than ruminants, and that the smaller nutritive effect of the organic matter of hay in the case of horses is attributable to the greater loss in the feces—that is, to inferior digestibility. The results indicate that a botanical analysis of hay furnishes a satisfactory means of judging of its nutritive quality.

It was found that although cattle refuse hay made in the ordinary way from sedges and rushes, yet they will readily eat these plants when cured as sour hay—that is, allowed to ferment in pits. The nutritive value of this hay is, however, small at best.

The nutritive value of dried wine lees, S. Weiser (*Landw. Jahrb., 35* (*1906*), *No. 1–2, pp. 224–238*).—Digestion experiments with horses and steers showed that dried wine lees did not have a high nutritive value, in part at least owing to the stems and seeds present, which constituted 22 per cent of the whole. The urine was analyzed.

Composition and feeding value of cucurbits, A. ZAITSCHEK (*Landw. Jahrb., 35 (1906), No. 1–2, pp. 245–258*).—Digestion experiments were made with steers and pigs to determine the digestibility and nutritive value of cucurbits of different sorts fed with hay.

The coefficients of digestibility with steers, calculated for pumpkins alone, were protein 70.3, fat 90.1, nitrogen-free extract 89.4, crude fiber 67.5, pentosans 68.7, and ash 72.6 per cent. The coefficients obtained in the tests with pigs were protein 72.3, fat 57.0, nitrogen-free extract 92.7, crude fiber 67.6, pentosans 70.1, and ash 61.9 per cent. The author believes that other sorts of cucurbits would have practically the same nutritive value.

The urine was analyzed and the amount of methan excreted was calculated. Taking these facts into account the physiological nutritive value of the cucurbits for steers was 70.2 and for pigs 69 per cent.

The nutritive value of ground beech bark, A. ZAITSCHEK (*Landw. Jahrb., 35 (1906), No. 1–2, pp. 239–244*).—Digestion experiments were undertaken with sheep and pigs to ascertain the nutritive value of ground beech bark, a material offered as a feeding stuff in times of scarcity. The sheep could not be induced to eat the material even when mixed with molasses. The mixture was, however, eaten by swine, but the ground beech bark was found to be wholly indigestible. Analyses were made of the urine.

Report of progress regarding the proposed act to be introduced by the Dominion government relative to the sale of concentrated feeding stuffs, W. P. GAMBLE (*Ann. Rpt. Ontario Agr. and Expt. Union, 25 (1905), pp. 59–61*).—The need for a law requiring an inspection of concentrated feeding stuffs in the Dominion of Canada is spoken of and a report given of the efforts which have been made to secure the enactment of such legislation.

Fattening cattle for the years 1904 and 1905, F. B. LINFIELD (*Montana Sta. Bul. 58, pp. 57–82*).—Continuing earlier work (E. S. R., 15, p. 709) 2 tests with steers are reported.

In the first test crushed wheat, ground oats, ground barley, and a mixture of equal parts of these grains were compared, the coarse fodder in every case consisting of clover hay. Each of the 4 lots contained 8 steers and the test as a whole covered 101 days. The average daily gain ranged from 2.06 lbs. per head on wheat to 2.35 lbs. on mixed grains. The greatest range in feed required per pound of gain and in the cost of feed per pound of gain was also noticed with these two lots, being respectively 1.83 and 2.15 lbs. and 4.56 and 5.33 cts. Considering this and earlier work the author estimates on the basis of the amounts required per pound of gain that the different grain rations supplemented by clover hay rank as follows: Mixed grain, barley, wheat, and oats.

In the second test different amounts of grain (barley, oats, and bran 2 : 1 : 1) were compared, the daily grain rations being respectively 3, 5, 7, and 10 lbs. per head. The coarse fodder in every case consisted of clover hay. Each of the 4 lots contained 6 steers and the feeding period covered 129 days. The smallest gain, 1.16 lbs. per head per day, was noted with the 5-lb. grain ration and the greatest gain, 1.37 lbs. per head per day, with the 10-lb. grain ration. The feed required per pound of gain ranged from 1.89 lbs. on the 3-lb. grain ration to 5.16 lbs. on the 10-lb. grain ration. The greatest variation in cost of feed per pound of gain, namely, 6.7 and 9.5 cts., was also noticed with these two lots.

"The results of the tests made during the winter 1902–3 and 1903–4 seemed to show that the relative value of the different grains (when fed with clover) to produce increase in live weight on a steer, is: 1st, mixed grain; 2d, barley; 3d, wheat; 4th, oats.

"In this test while the steers fed the larger grain ration gained more and faster than those fed the smaller grain ration, yet the gains were in no wise in proportion to the difference in the grain."

Feeding range steers, J. J. VERNON (*New Mexico Sta. Rpt. 1904, pp. 27, 28*).—The value for winter feeding of alfalfa hay alone and supplemented by a light grain ration of bran and cracked wheat 1:3 was tested with 2 uniform lots of 5 2-year-old range steers each. On alfalfa and grain the net profit was calculated to be $7.42 per ton of hay and on the hay alone $8.40.

The quantity of milk taken by nursing calves and its fat content, T. HENKEL and E. MÜHLBACH (*Landw. Vers. Stat., 63 (1906), No. 5–6, pp. 407–469, figs. 12*).—It was found in the experiments reported on methods to be followed with nursing calves that the best results were obtained when the calf nursed at frequent and regular intervals. If the calf nurses before the cow has been milked at all, it obtains milk of low fat content. If, however, the cow has been milked somewhat, the calf obtains milk rich in fat. The effect of different methods of milking and other related questions are also considered.

Sheep feeding experiments for the years 1904-5, F. B. LINFIELD (*Montana Sta. Bul. 59, pp. 85–116*).—In the first of the feeding tests the comparative value of wheat screenings, wheat, oats, barley, and a mixture of equal parts of wheat, oats, and barley, was tested with 5 lots of lambs and 5 lots of wethers, each lot containing 24 animals. The grain ration in every case was supplemented by clover hay.

During the whole period of the test, 97 days, the greatest gain of the wethers, 0.219 lb. per head per day, was noted with the lot fed wheat, and the smallest gain, 0.187 lb., with the lot fed the mixed grain. The cost of a pound of gain was lowest, 7.49 cts., on wheat screenings, and greatest, 8.73 cts., on mixed grain. With lambs the greatest gain, 0.256 lb., was noted on wheat screenings, and the smallest gain, 0.219 lb., on wheat. These two rations also showed the greatest range in cost, a pound of gain being valued at 3.8 cts. on screenings and 5.57 cts. on wheat. Considering all the lots, the average gain with wethers was 0.2 lb. and with lambs 0.237 lb., the cost of a pound of gain in the two cases being 7.92 cts. and 4.61 cts.

For feeding wethers, the author ranks the grains as follows when fed with clover hay: Wheat, barley, oats, wheat screenings, and mixed grains; and for lambs—screenings, oats, barley, mixed grains, and wheat.

When sold, some of the lambs which were light weight at the beginning of the test were not sufficiently finished to bring the highest price, and the author concludes that 3 months' time is not a sufficiently long feeding period for such animals.

In a test, covering 65 days, of clover hay and grain, with and without roots, which was made with 2 lots of 32 sheep each, the average gain per head per day with the roots was 0.205 lb. and without roots 0.195 lb., the cost of a pound of gain in the 2 cases being 6.4 and 7.3 cts. The sheep included in this test had been used in experiments on the effects of poisonous plants, and some of them had lost weight during the summer. On an average they weighed 83 lbs. each at the beginning of the trial. The roots fed in this and the following test consisted of sugar beets, with occasionally mangels.

Using one lot of 16 and one of 14 sheep, wheat screenings and mixed grain (barley, oats, and bran 2:1:1) were compared, the ration in each case containing clover hay and roots in addition to grain. In 65 days the average gain on screenings was 0.193 lb. and on grain 0.3 lb. and the cost of a pound of gain 6.2 and 4.4 cts. The feeding was then continued for 58 days, both lots being fed clover hay and roots with the mixed grain. During this period the average

gain was 0.213 lb. per head per day, and the cost of a pound of gain 5.7 cts. The sheep used in this test were badly "locoed" and when received were hardly strong enough to stand. They weighed on an average 42.5 lbs.

"'Locoed' sheep that had been treated with vermifuges fed during 123 days gained as rapidly and made as economic gains as a band of healthy wethers. Being small and thin, however, they would have to be fed at least twice as long to get them ready for the market."

Heavy (1.5 lb.) and light (1 lb.) grain rations were compared with 100 wethers divided into 2 uniform lots. The grain consisted of the mixture mentioned above and was supplemented by clover hay. On the heavier ration the average daily gain in the 65 days covered by the test was 0.208 lb. per head, and on the lighter ration 0.202 lb. per head, the cost of a pound of gain in the 2 cases being 6.5 and 7.3 cts. and the grain eaten per pound of gain 1.81 and 2.61 lbs. with 18.3 lbs. clover hay on an average.

Experiments with Suffolk and Lincoln crossbred sheep at Glen Innes Experimental Farm (*Agr. Gaz. N. S. Wales, 17 (1906), No. 3, pp. 236–238, fig. 1*).—The breeding tests were carried on by R. H. Gennys, who found that the Lincoln-Merino cross produced heavier wool than the Suffolk-Merino. The wool of all the crosses was much improved by the Merino blood. As mutton sheep the Suffolk-Merino crosses, both as lambs and as full-grown sheep, were superior to the others. Sufficient data have not yet been accumulated regarding the Rommey and Shropshire crosses for drawing deductions.

Effect of covering the body on the distribution of fat, J. Bergonié (*Compt. Rend. Soc. Biol. [Paris], 60 (1906), No. 16, pp. 791, 792*).—Experiments with lambs with one-half the body shorn at intervals of 8 days failed to show any effect upon the formation of fat. Slight differences in the distribution of the fat on the shorn and unshorn sides were noted.

Pig feeding experiments, F. B. Linfield (*Montana Sta. Bul. 57, pp. 39–56*).—In the first of the tests reported the relative efficiency of grain and alfalfa hay and grain and roots with and without exercise was studied with 4 lots of 4 pigs each, the test covering 80 days. The roots fed in this and other tests were nearly always sugar beets. The average daily gain per pig on grain and hay with exercise was 0.57 lb. and without exercise 0.42 lb., and on grain and roots with exercise 0.65 lb. and without exercise 0.30 lb.

In the second test barley and bran alone and supplemented by skim milk and by clover hay were compared with 3 lots of 5 pigs each for 98 days.

The third test was like the second except that sugar beets as a supplement to barley and bran were also included. This test covered 81 days and the 4 lots contained 4 pigs each. Considering both tests the average gain on grain alone was 0.92 lb., on grain and skim milk 1.37 lbs., and on grain and clover hay 1 lb. per head per day. The corresponding gain on sugar beets was 1.09 lbs.

In the third test the lots fed barley and bran and grain and clover hay were not ready for market at the close of the test, so the feeding was continued for 17 days, the ration consisting of the grain mixture supplemented by roots and skim milk. The average daily gain per head was 1.8 lbs.

In the fourth test reported full rations of grain wet up with water and with skim milk were compared with a one-fourth grain ration mixed with water, the rations in every case being supplemented by pasturage. Two of the lots contained 3 pigs each and the remaining lot 2 pigs. The test covered 55 days. On the full grain ration mixed with water the gain was 1.41 lbs. per head per day, on the full grain ration with skim milk 1.70 lbs., and on the half grain ration 0.94 lb.

Omitting the first test and the supplementary period of the third test the author calculates that on grain alone 5.28 lbs. were required for a pound of gain and smaller amounts when other feeds supplemented the grain.

The author calculates that in none of the tests did the pigs return the market price for the feed if valued at 4 cts. per pound live weight. If sold at 6 cts. per pound the calculated gain would average $1.85 per 100 lbs. feed.

"A point of considerable importance is that this result indicates that when running on pasture, hogs will keep in good condition and even gain in live weight on a light grain ration. There are yet many other facts, however, to be worked out along the lines of this test.

"The important point brought out in this test is the value of some supplementary food added to the grain ration in fattening hogs. . . .

"In these tests, skim milk, sugar beets, clover, or alfafa have been used, and their value seems to be in the order named. It is apparent that in some way these additional foods have a value beyond what their composition would indicate. These supplementary foods seem to act in two or three ways. 1st, they seem to stimulate the appetites of the animals so that they eat more of the grain and make more economic gains because there is a larger surplus over the requirements of the body to turn into meat. 2d, these supplementary foods may aid the digestion of the hogs so that they can make better use of the food given them."

Digester tankage for swine, R. S. Shaw (*Michigan Sta. Bul. 237, pp. 149–157*).—So much milk is supplied to cheese factories, condensed-milk factories, and sold to cities and towns that on many farms there is a scarcity of skim milk for feeding young calves and pigs. A substitute for skim milk is, therefore, desirable and the value of digester tankage for this purpose was studied for young pigs in 1 test of 56 and 2 tests of 70 days' duration with pigs 50 to 120 days old at the beginning of the trial.

In one of the tests corn meal, middlings, and tankage 3 : 3 : 1 mixed with water were compared with the same grain ration mixed with skim milk. In the other tests middlings and corn meal 2 : 1 with the addition of one-eleventh of tankage wet up with water were compared with the same grain ration mixed with skim milk in the proportion of 1 lb. of meal to 3 lbs. of milk.

On the tankage rations the average daily gain was 0.98 lb. and the feed consumed per pound of gain 3.14 lbs. On the meal and skim milk rations the average daily gain was 1.08 lbs. per head and the feed required per pound of gain 2.48 lbs. meal and 5.67 lbs. skim milk. In a check test covering 10 weeks in which 2 lots of 5 pigs each were fed middlings and corn meal 2 : 1 mixed to a thick slop with water 4.09 lbs. of meal were required per pound of gain, the average daily gain being 0.8 lb.

"The indications . . . are that digester tankage can be used successfully as a substitute for skim milk in the ration for the growing pig from weaning time on." The results suggest "that a slightly greater proportion of tankage than one-eleventh of the ration could be fed, increasing the gains somewhat, and still keeping within the cost of production of the skim milk ration."

Corn meal and digester tankage in the proportion of 5 : 1 and 9 : 1 were compared for fattening pigs with rations of corn meal only and with rations of middlings and corn meal 2 : 1 with and without the addition of one-eleventh of tankage. The tests covered from 70 to 98 days. The average daily gain per pig on the tankage rations was 1.19 lbs. and on the rations without tankage 0.98 lb. The average cost of a pound of gain with tankage was 4.44 cts. and without tankage 4.86 cts.

"The gains were greatest in every case where tankage was used in the ration and this was more and more noticeable as the feeding period was prolonged. . . .

In general the figures given indicate that tankage can be used to good advantage in the ration for the fattening hog as well as for the growing pig."

Motion and muscular work in relation to digestion in horses, A. Scheunert (*Landw. Jahrb., 34 (1905), No. 5, pp. 805–827*).—Practical deductions are drawn from experiments previously reported (E. S. R., 17, p. 585). If work is reasonable in amount and not continued until great fatigue is induced it does not exercise any unfavorable effect upon the digestion in horses, but, on the other hand, may exercise a favorable effect. Animals which have worked before they are fed and are allowed to rest after eating digest their food in the same way as horses at rest.

The Ranidæ: How to breed, feed, and raise the edible frog (*Allendale, N. J.: Meadow Brook Farm, 1905, pp. 31, figs. 9*).—The author believes that frog raising for market may be made a profitable industry and some directions are given which, it is claimed, are based on experience. The life history of the frog is described.

The author states that the common frogs of America are *Rana esculenta* and *R. temporaria* and recommends the former as the species which should be raised for market. In his statements he has apparently confused the English and American species as it is *R. catesbiana*, a large frog, which is commonly eaten in the United States, whereas the small English frog (*R. esculenta*) is not indigenous here.

Studies in oyster propagation, J. Nelson (*New Jersey Stas. Rpt. 1905, pp. 400–421, pls. 14*).—Cloth and felt covered boxes were devised in which fertilized oyster spawn was placed together with suitable material to which the young oysters could attach themselves. These boxes were placed in a number of localities to study the conditions under which oyster spat forms, the experiment as a whole being a continuation of earlier work on oyster propagation (E. S. R., 17, p. 393). The results obtained were for the most part negative.

"It seems evident that spawn artificially prepared lacks something to enable it to grow into spat, or possibly there was an element lacking in the boxes. These points must be investigated next season."

In general, the boxes were regarded as satisfactory. The water inside seemed to be pure and as rich in oyster food as that outside. The fixation of oyster spat and the genesis of oyster spawn are illustrated by a number of plates.

First lessons in poultry keeping, J. H. Robinson (*Boston: Farm Poultry Pub. Co., 1905, pp. 168, figs. 61*).—In a series of lessons designed for home instruction, breeding, feeding, care of poultry, the use and management of incubators, the construction and furnishing of poultry houses, and related questions are taken up.

Poultry work for 1905, J. H. Shepperd (*North Dakota Sta. Rpt. 1905, pp. 46–48*).—A brief summary of data on the eggs laid, set, and hatched; the poultry used and sold; and the finances of the station poultry department.

The American standard of perfection (*Amer. Poultry Assoc., 1906, pp. 299, figs. 124*).—As stated in the subtitle, this volume contains a description of all varieties of fowls, including domestic poultry, ducks, turkeys, and geese, recognized by the American Poultry Association and is designed as a manual for judging poultry. This edition was prepared at the twenty-eighth annual meeting of the American Poultry Association at Rochester. The material published in earlier editions has been revised and new breeds and varieties have been added, "but the policy has been, and is, to admit only such as have become well established and that clearly are entitled to the distinctive term 'standard-bred.'" The volume also contains a glossary of technical terms and the constitution and by-laws of the American Poultry Association.

The production of brown or tinted eggs (*Jour. Bd. Agr.* [*London*], *12* (*1906*), *No. 10, pp. 611–613*).—Since brown-shelled eggs are preferred in the British market and bring a higher price their production is discussed. Langshans, Cochins, Plymouth Rocks, Orpingtons, Game, Wyandottes, Brahmas, Faverolles, and Coucous de Malines produce eggs of the desired color. A number of satisfactory crosses are also suggested. "In crossing two breeds producing respectively white and tinted eggs, it is necessary to depend chiefly upon the females for conservation of the tinted characteristic, and it is advisable that in such crossing the male only should be selected from the white egg-producing races."

Egg production of virgin fowls, J. NELSON (*New Jersey Stas. Rpt. 1905, pp. 393–400*).—The presence of the male bird on egg production was studied, but the results obtained up to the present time are not regarded as sufficient for general deductions. In general, more broody hens were noted in the lot having the male bird, but the differences were not very great.

DAIRY FARMING—DAIRYING.

Feeding experiments, G. A. BILLINGS (*New Jersey Stas. Rpt. 1905, pp. 336–349*).—The feeding experiments reported in 2 recent bulletins of the station (E. S. R., 17, p. 900) are summarized and an account is given of a comparative test of 2 grain rations, one consisting of 5 lbs. of dried distillers' grains and 5 lbs. of wheat bran, and the other of 4.5 lbs. of dried brewers' grains, 4.5 lbs. of wheat bran, and 1 lb. of cotton-seed meal. The test was made with 4 cows and lasted 30 days. The first ration mentioned, as compared with the second, increased the average daily yield of milk 5 lbs. per cow and the fat content 0.07 per cent and decreased the cost of production 11.4 cts. per 100 lbs. of milk and 1.32 cts. per pound of butter.

Experiments with the dairy herd, G. A. BILLINGS (*New Jersey Stas. Rpt. 1905, pp. 376–390, pls. 6*).—The improvement of dairy herds is briefly discussed and an experiment in breeding a pure-bred Guernsey sire upon common stock is reported. The records of 1 dam and 4 heifers are given. In every instance the fat content of the milk of the offspring was higher than that of the mother. This practice is recommended not only for increasing the fat content of the milk but for giving the milk a higher color.

Notes are given on the construction of concrete mangers for cattle and on improvements in the milk room at the station, including the laying of a concrete floor.

The value of keeping milk records is illustrated by the records of the college herd. The data obtained during 9 years on the cost of producing and handling milk indicate that cows producing yearly less than 5,000 lbs. of milk containing 4 per cent of fat are unprofitable. With milk at 3 cts. per quart the records show that 30 cows have returned profit over and above the value of manure, while 11 were unprofitable. With butter at 20 cts. per pound only 13 out of 44 cows showed any profit above the manure after deducting for feed, labor, interest on the capital invested, and depreciation of the herd.

Dairying, J. J. VERNON (*New Mexico Sta. Rpt. 1904, pp. 28, 29*).—In experiments with 8 cows, feeding bran with alfalfa hay was compared with feeding alfalfa hay alone. In 12 weeks 4 cows consumed 11,207 lbs. of alfalfa hay and 2,700 lbs. of bran and produced 5,543 lbs. of milk, while 4 cows fed alfalfa alone consumed 11,378 lbs. of hay and produced 4,628 lbs. of milk.

Tests of Guernsey cows for advanced registry (*Connecticut State Sta. Rpt. 1905, pt. 6, p. 343*).—Nine cows were tested during the year, the records of 3 being given.

Milking trials (*Jour. Brit. Dairy Farmers' Assoc., 20 (1906), pp. 135–169*).—Two-day tests of 73 cows and 8 goats are reported in detail. Summaries of previous tests have been noted in E. S. R., 16, pp. 594 and 1118. The average yield of milk in pounds and the contents of fat and solids-not-fat in percentages for the tests in 1905 by breeds are respectively as follows: Shorthorn, 49.1, 3.85, and 8.99; Jerseys, 34.7, 5.25, and 9.14; Guernseys, 31.4, 4.81, and 9.15; Red Polls, 38.5, 3.63, and 8.93; Kerries, 28.2, 4.10, and 8.96; and crosses, 45.7, 3.82, and 9.08.

An experimental inquiry into the factors which determine the growth and activity of the mammary glands, J. E. LANE-CLAYPON and E. H. STARLING (*Proc. Roy. Soc. [London], Ser. B, 77 (1906), No. B 520, pp. 505–522, pl. 1*).—The experiments consisted in injecting fluid extracts of the ovary, uterus, placenta, and fetus into virgin rabbits with a view to producing changes in the mammary glands which occur normally in pregnancy. In 6 cases the authors produced in this way a branching in the ducts of the mammary glands, a proliferation of the epithelial cells, and in one instance a formation of secreting acini. While the results were not considered entirely conclusive they favor the view advanced by Hildebrandt that the growth of the mammary gland during pregnancy is due to the action of a specific chemical stimulus produced largely in the fetus, which inhibits the secretory activity of the gland cells. Lactation is, therefore, due to the removal of this substance.

The elimination of nitrates by the mammary gland, L. MARCAS and C. HUYGE (*Bul. Agr. [Brussels], 22 (1906), No. 2, pp. 217–225*).—The dependence placed upon the presence of nitrates in milk as a proof of watering, led the authors to administer potassium nitrate to 22 cows and test their milk by diphenylamin. Nitrates were irregularly detected in the milk.

On the bacteriological conditions of the udder and the milk, C. BARTHEL (*K. Landtbr. Akad. Handl. och Tidskr., 45 (1906), No. 1, pp. 48–56*).—The author corroborates Ward's and von Freudenreich's conclusions that bacteria normally find their way into the udder of the cow, and shows that these are mostly cocci, while typical milk bacteria are not able to invade the udder. The article gives a review of the results of investigations conducted along this line by Conn and Stocking, Kolle, Sommerfeld, and others.—F. W. WOLL.

Bitter milk, C. HUYGE (*Bul. Agr. [Brussels], 22 (1906), No. 2, pp. 213–216*). This gives the cultural characteristics of a bacillus isolated from bitter milk. The organism was destroyed in whole milk by sterilizing at 105° for 5 minutes and in cream by heating at 90° for 5 minutes on 3 successive days. The thorough application of this method caused the disappearance of this trouble from the dairy under investigation.

Spontaneous heat production in cows' milk and lactic acid fermentation, M. RUBNER (*Arch. Hyg., 57 (1906), No. 3, pp. 244–268, figs. 10*).—The author investigated the amount and sources of the heat produced during the spontaneous souring of milk. Numerous determinations showed that less than one-half of the heat produced during the lactic fermentation was due to the decomposition of the milk sugar and accordingly that the proteids or fat must also be concerned in the heat production.

The action of formalin and hydrogen peroxid in milk, P. BANDINI (*Centbl. Bakt. [etc.], 1. Abt., Orig., 41 (1906), Nos. 2, pp. 271–279; 3, pp. 379–386; 4, pp. 474–480*).—The author studied the action of rennet in milk treated with different quantities of formaldehyde and hydrogen peroxid, the effect of these preservatives upon the soluble ferments of milk, the action of artificial ferments in milk preserved with these substances, and the amounts of formaldehyde and hydrogen peroxid required to preserve milk for practical purposes.

The results of the experiments showed that formaldehyde tends to prevent the curdling of milk with rennet, the extent of this influence being greater the longer the preservative is in the milk and the larger the amount used. On the other hand, rennet acted the same in the case of milk preserved with hydrogen peroxid as upon normal milk. Neither preservative exerted an appreciable influence upon the soluble ferments normally present in milk. Unlike hydrogen peroxid, formaldehyde even in small quantities retarded the proteolytic action of rennet and pancreatin and when used in large amounts produced marked changes in the physical and chemical properties of the casein. In the proportion of 1:5,000 to 1:10,000 formaldehyde preserved milk from 6 to 12 days. The author considers it highly probable that the continued use of milk so preserved would be injurious. Hydrogen peroxid in amounts of 1 to 3 per cent preserved milk 3 to 6 days and such milk is believed to be in no way injurious. A bibliography is appended.

On the addition of foreign fats to milk, C. GIRARD (*Abs. in Chem. Ztg., 30 (1906), No. 41, p. 504*).—The author's experiments were made with cocoanut oil, lard, cotton-seed oil, margarin, etc., and showed that the addition of these materials to milk required special apparatus and the employment of a temperature of 80° C., which gave the mixture a taste rendering it unpalatable.

Grading cream, O. ERF (*Kansas Sta. Bul. 135, pp. 133–144*).—In the dairy department of the college cream has been graded for nearly 2 years with, it is stated, universal satisfaction to the patrons and a marked improvement in the quality of the cream. According to the scheme used, cream to be of first grade should contain not more than 0.2 per cent of acid, have no undesirable flavors or odors, be not over 3 days old, and contain not less than 30 per cent of fat. Second-grade cream may contain as much as 0.3 per cent of acid but should be untainted, not more than 5 days old, and should contain 30 per cent or more of fat. Third-grade cream may be somewhat stale and tainted and contain less than 30 per cent of fat. It is estimated that there should be a difference in price of at least 4 cts. between the first and second grades and not less than 2 cts. between the second and third.

The bulletin also discusses the grading of butter, gives directions for the determination of the acidity of cream, enumerates the causes of undesirable flavors and odors in cream, and makes suggestions concerning the proper care and handling of cream.

A new Babcock milk-testing bottle, R. C. WHITMAN (*Jour. Amer. Med. Assoc., 47 (1906), No. 3, pp. 204, 205*).—The bottle described has been designed for testing small quantities (5 cc.) of milk and for use in an ordinary urine centrifuge. Into the neck of the bottle proper is ground a graduated glass tube, making both not to exceed 5½ in. in length. It is stated that the bottles have been compared repeatedly with the regulation Babcock bottles and have given identical results.

Examination of Babcock test apparatus (*Connecticut State Sta. Rpt. 1905, pt. 6, p. 343*).—During 1905, 4 pipettes, 216 cream-test bottles, and 73 milk-test bottles were tested. All were found accurate except 4 milk-test bottles.

Investigations in the manufacture and storage of butter. I, The keeping qualities of butter made under different conditions and stored at different temperatures, C. E. GRAY; **with remarks on the scoring of the butter,** G. L. MCKAY (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 84, pp. 24*).—This bulletin, which is the first of a contemplated series, gives results of one season's work in making butter under different conditions and storing it under different temperatures. The plan embraced a study of the keeping qualities of butter as affected by (1) temperature of storing, (2) pasteurization of cream, (3) salting,

(4) packing in tubs and cans, and (5) filling cans partly and entirely full. The results are summarized by Mr. Gray as follows:

"Butter containing low percentages of salt kept better than did butter of the same lot containing higher percentages of salt.

"Butter in full cans and tubs at −10° and +10° F. scored about the same. At +32° F. there was a slight difference in favor of cans.

"Butter in full cans kept much better than did butter in cans only partially full, the deterioration doubtless being due to the presence of air in the partially full cans.

"Butter held at −10° F. kept best, both when in storage and after removal from storage.

"Butter made from cream received at the creamery sweet and in good condition kept well while stored at −10° and +10° F.; also after removal from storage, giving results wholly satisfactory.

"Butter made from cream received at the creamery sour and in fair condition kept well while in storage at −10° and +10° F., but deteriorated rapidly after removal from storage, giving, on the whole, results which were very unsatisfactory."

Professor McKay, who was one of the judges, comments upon the scoring of the butter, concluding from all the data at hand that in these experiments light salting and low temperatures gave much the best results for storage butter.

Yields of salted and unsalted butter, F. FRIIS (*Abs. in Maelkeritid., 19 (1906), No. 19, pp. 430–433*).—Trials were conducted in two different creameries to determine the yields of butter from ordinary ripened cream, with and without salting. The butter was worked three times, the second time 1 to 1½ hours after the first working, and the third time 3 to 4 hours after the second. Both the cream and the buttermilk contained about the same amounts of butter fat in each trial. For each 100 lbs. of salted butter an average of 98.5 lbs. of unsalted butter was obtained, the increase in the yield of salted butter being caused by the 3.5 per cent of salt added, which more than made up for the greater loss through working out of water. The average water content of the salted butter was 14.42 per cent and of the unsalted 15.31 per cent. The solids-not-fat in the salted butter averaged 3.27 per cent and in the unsalted 1.17 per cent.—F. W. WOLL.

Denmark's butter exports, 1904–5, B. BÖGGILD (*Tidsskr. Landökonom., 1905, No. 12, pp. 630–644*).—The article contains the usual summary of butter imports and exports from Denmark during the year ending September 30, 1905. The imports amounted to about 39,000,000 Danish pounds, and the exports to 190,000,000 pounds. The net exports, therefore, amounted to 151,000,000 pounds, 1,000,000 pounds less than the preceding year.—F. W. WOLL.

The cold storage of cheese, C. B. LANE (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 83, pp. 26, pls. 6, figs. 4*).—The author, aided by D. Stuart, has brought together the results of experiments carried out by the late Maj. H. E. Alvord, during 1903–4, to determine the influence of different temperatures of storing upon the weight and quality of parafined and unparafined cheese. The temperatures compared were 28°, 34°, and 40° F. Parafined and unparafined lots of the 3 types of cheese known commercially as Cheddars, Flats, and Young Americas, weighing on an average 68, 37.7, and 10.4 lbs., respectively, and aggregating about 3 tons, were stored at these temperatures, and in addition a test on a much smaller scale was made of the effect of storing cheese at a temperature of about 5°.

During 247 days the unparafined Cheddars stored at 40° lost 5.87 per cent in weight, at 34°, 5.12 per cent, and at 28°, 2.88 per cent. During the same period the Flats lost at 40°, 5.53 per cent; at 34°, 4.37 per cent, and at 28°, 2.19

per cent. During 233 days the Young Americans lost at 40°, 9.34 per cent; at 34°, 6.95 per cent, and at 28°, 4.25 per cent. Assuming that the cheese sold at a uniform price of 10 cents a pound, the profits in storing at 28° over 40° were 30 cents per hundred for Cheddars, 33 cents for Flats, and 51 cents for Young Americas.

Paraffining reduced the loss in weight of the Cheddars to 3.19 per cent at 40°, 1.36 per cent at 34°, and 1.27 per cent at 28°, and the loss in weight of the Young Americas to 2.38 per cent at 40°, 2.11 per cent at 34°, and 1.45 per cent at 28°. Comparing paraffined cheese at 28° with unparaffined cheese at 40°, the saving from paraffining amounted to 46 cents per hundred for Cheddars and Flats and 52 cents for Young Americas.

The quality of the cheese was not influenced to any marked degree by the different temperatures used and was not injured in any instance by paraffining.

Investigations in the manufacture and curing of cheese. VI. The cold curing of American cheese, with a digest of previous work on the subject, C. F. Doane (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 85, pp. 68*).—After reviewing previous experiments in cold and cool curing of cheese in the United States and Canada, the author reports an experiment made at Plymouth, Wis., for the purpose of determining the effect of different low temperatures of storage and the time of putting into storage upon the curing of the cheese. The cheese used was manufactured under strictly commercial conditions, placed in storage directly from the press and at the age of one and two weeks, and held at temperatures of 32° and 40° F. Rennet was used for part of the cheese at the rate of 3 oz. per 1,000 lbs. of milk, and for the remainder at double this rate. All the cheese was paraffined. The details of manufacture, the weights of cheese at different periods, and the numerical and descriptive scores are presented in tabular form and discussed.

Paraffining and placing in storage at the end of one week lessened considerably the loss in weight, as compared with paraffining and storing at the end of two weeks. This was considered the most interesting feature of the results so far as loss in weight was concerned. In many cases there was no shrinkage whatever from the time of paraffining to the time of final weighing, 5 to 7 months later.

The average total scores for low rennet cheese were as follows: Placed in storage directly from the press and held at 32°, 95, and at 40°, 94.3; placed in storage at the end of 1 week and held at 32°, 93.8, and at 40°, 90; placed in storage at the end of 2 weeks and held at 32°, 93, and at 40°, 90, and cured at the factory 81.4. The scores for the high rennet cheese were as follows: Stored from the press at 32°, 94.4, and at 40°, 92.3; stored at the end of 1 week at 32°, 93.4, and at 40°, 90.3; stored at the end of 2 weeks at 32°, 91.6, and at 40°, 90.9, and cured at the factory, 90.5.

In some instances taints developed in cheese kept out of cold storage for 1 and 2 weeks, but did not appear in the cheese placed in storage directly from the press. Furthermore, when the taints had once started to develop, the 32° temperature served much better to hold them in check than the 40° temperature. The author therefore believes that the greatest beneficial influence of cold curing is with what would otherwise be poor cheese. Contrary to the belief generally held by dealers, the results indicate that cheese with too much acid should be placed in cold storage as quickly as possible and the colder the room the better.

The high rennet cheese ripened more rapidly than the low rennet cheese, and held its good qualities fully as long if not longer.

The manufacture of Lancashire cheese, F. J. Lloyd (*Jour. Brit. Dairy*

Farmers' Assoc., 20 (1906), pp. 36–52).—The author has investigated the methods of making cheese in Lancashire and in this article makes suggestions for overcoming faults and difficulties observed by him, and reports some experimental work. Determinations were made of the acidity during different stages in the process of manufacture. It was found that those cheeses which contain from 0.95 to 1 per cent of acid in the liquid from the press were on the whole best. Previous investigations with Cheddar cheese showed that for a slow ripening cheese an average acidity of about 0.85 per cent in the liquid from the press is required, for a quick ripening cheese an acidity of 1 per cent, and for a very quick ripening cheese about 1.15 per cent. The same standards are found to hold good for Lancashire cheese. Bacteriological studies showed that the flora of this cheese is quite different from that of other varieties.

The distribution of lactic-acid bacteria in curd and cheese of the Cheddar type, F. C. HARRISON (*Rev. Gén. Lait, 5 (1906), No. 18, pp. 409–415, pls. 4*).—The author has made use of the histological methods employed by Petersson, Gorini, and Rodella (E. S. R., 17, p. 400). The best results were secured by embedding the curd or cheese in paraffin with bergamot oil and staining the sections on cover glasses with Gram's method and counterstaining with eosin. By this method lactic-acid bacteria, yeasts, and torulæ were well demonstrated. Bacteria of the colon type which decolorize by Gram's method were brought out by counterstaining with Bismarck brown. By decolorizing and dehydrating in amyl alcohol, practically all the bacteria were stained.

The lactic-acid bacteria were found to increase very rapidly in numbers from the time of adding the rennet until the time of salting, but only slightly from the time of salting until the cheese was 1 or 2 days old. Comparison, however, was rendered difficult by the large numbers present. They showed a tendency to form clumps or colonies, in some of which over 1,000 were counted. The results by this method are considered as confirming quantitative analysis by the plate method.

Composition of the principal types of cheese consumed in France, LINDET, AMMANN, and BRUGIÈRE (*Rev. Gén. Lait, 5 (1906), No. 18, pp. 416–418*).—Analyses of 24 types of cheese by the same methods and under identical conditions are reported.

Investigations on the ripening of cheese, G. CORNALBA (*Ann. Soc. Chim. Milano, 12 (1906), No. 1–2; abs. in Rev. Gén. Lait, 5 (1906), No. 18, p. 419*).—In Grana and other types of cheese investigated, ripening was found to progress centrifugally, the quantity of soluble casein in the ripened cheese was limited and the formation of ammonia from the soluble casein was considerable. Butyric acid predominated in the Grana cheese, though caproic, acetic, and higher acids were present. The fat did not undergo any change, the volatile fatty acids not being saponified by the ammonia.

A handbook for test associations, N. HANSSON (*Kontrollföreningarnes arbetsfält. Malmö: E. Janssons, 1905, pp. 125, figs. 12*).—This contains a sketch of Swedish dairy test associations, with directions for feeding and milking cows, weighing and testing milk, and keeping records. In September, 1905, there were 326 different associations in Sweden. The membership of 298 associations for which complete statistics are given was 3,447. The total number of cows owned by members of the association was 12,701.—F. W. WOLL.

A handbook for members of test associations, R. GRIPENBERG (*Kort Handledning i Utfodringskontroll. Helsingfors: Gort., 1905, pp. 25*).—This contains brief directions for the control of the feeding and production of cows in test associations with schedules and blanks to be used.—F. W. WOLL.

Profitable dairy farming, N. HANSSON (*En lönande ladugårdsskötsel.*

Malmö: E. Janssons, 1905, 2. ed., pp. 136, figs. 31).—A popular illustrated treatise on dairy husbandry, including the breeding and feeding of the dairy herd.—F. W. WOLL.

VETERINARY MEDICINE.

Annual report on progress with pathogenic micro-organisms, including bacteria, fungi, and protozoa, P. VON BAUMGARTEN and F. TANGL (*Jahresber. Path. Mikroorgan., 19 (1903), pp. XII+1220*).—An elaborate review is presented of the literature on pathogenic micro-organisms which appeared in 1903. The editors were assisted by a large corps of specialists who divided up the work according to their particular qualifications. The review of literature includes text-books and original articles or treatises on all forms of pathogenic cocci, bacilli, and other forms of bacteria and fungi, including actinomyces, protozoa of all groups which furnish pathogenic forms, as well as works on general microbiology, disinfection, and biological technique. Bibliographies are furnished in connection with each section, and the volume is also supplied with complete author and subject indexes.

Collected studies on immunity, P. EHRLICH, trans. by C. BOLDUAN (*New York: John Wiley & Sons; London: Chapman & Hall, Ltd., 1906, pp. XI+586, pl. 1*).—Since the publication of the German edition of this collection, two additional chapters have been prepared by Ehrlich and Sachs, which are also included in the present English edition, and a general review of recent work in immunity was prepared by Ehrlich expressly for the translation. The subject of immunity in so far as the writings of Ehrlich and his disciples are concerned is therefore brought down to date. The original German edition has already been noted (E. S. R., 16, p. 96).

The local treatment of parasitic and infectious diseases with remedies introduced in connection with an electric current, D. BERNARDINI (*Clin. Vet. [Milan], 29 (1906), No. 20, pp. 490–494*).—From time to time experiments have been made to determine the influence of an electric current in hastening and intensifying the penetration of drugs applied locally. The author secured some rather positive results from the use of this method. Rabbits were inoculated with anthrax cultures in the tissue of the ear and after 3 hours a solution of corrosive sublimate was applied to the point of inoculation under the influence of an electric anode for a period of 10 minutes. Another rabbit was treated in the same manner except that the application of an electric current was omitted. After 56 hours it appeared that the rabbit which was not treated with electricity exhibited all of the bacteriological and pathological symptoms of anthrax while the other animal remained entirely normal.

Public abattoirs. I, Construction and arrangement, J. DE LOVERDO (*Abattoirs publics. I, Construction et agencement. Paris: H. Dunod & E. Pinat, 1906, pp. VIII + 902, pls. 11, figs. 375*).—This volume contains an elaborate account of the construction of abattoirs in France and other countries, particular attention being given to those in France with historical notes on the development of abattoirs in that country. The author discusses in a detailed manner the various points of construction, arrangement of rooms, and apparatus and other matters related to the architecture, sanitary regulation, ventilation, and use of abattoirs. Particular attention is given to cold storage plants and their proper regulation in connection with abattoirs as well as to various other secondary industries dependent upon abattoirs.

Public abattoirs. II, Inspection and administration of abattoirs and cattle markets, H. MARTEL, J. DE LOVERDO, and MALLET (*Abattoirs publics.

II. Inspection et administration des abattoirs installation des marchés aux bestiaux. Paris: H. Dunod & E. Pinat, 1906, pp. VI + 645, pls. 8, figs. 110).—This volume completes the general account of abattoirs and contains a detailed discussion of the administration and inspection work to be carried on in abattoirs and small slaughterhouses. The subject-matter is arranged under a number of different heads, including sanitary inspection of animals, the reasons for inspection, the obligations of meat inspectors, condemnation of meat, French legislation, methods of inspection of various animals, stations for inspecting imported meat, inspection of private abattoirs, special inspection of meat for use by the army, the use of horses and dogs for food, inspection of animals before slaughter by veterinary police, meat legislation in countries other than France, inspection of abattoirs and connected buildings for sanitary conditions, general administration of abattoirs and cattle markets, and insurance against condemnation.

Report of the veterinarian, G. H. GLOVER (*Colorado Sta. Rpt. 1905, pp. 51–61*).—The work of the veterinarian has been largely confined to investigations relating to poisonous plants. In this work attention was given to a number of plants. Two pastures were arranged, one being free from loco and the other containing large quantities of both white and purple loco. Six steers and 7 horses were placed in each of these pastures in order to determine the effect of eating loco. The animals maintained in the pasture free from loco kept in good condition during the season, while those on the loco pasture were badly affected and finally all of them died. The injurious effects of eating loco were manifested within a week, the symptoms being those of general prostration and malnutrition. If such animals were removed from the loco pasture they soon recovered, but were again affected when replaced in the loco pasture. It appeared during the experiments that white loco was preferred and that the most positive results may be obtained with cattle. Post-mortem examinations failed to reveal any lesions. It was concluded from this work that the loco disease is a specific condition associated with at least one species of plant (*Astragallus mollissimus*). Horses and cattle prefer grass to the loco plant, which seems to have a low nutritive value. Animal parasites are not found in larger quantities in locoed animals than in other animals.

It is estimated that the annual losses from larkspur in Colorado are about $40,000. Five species have been found to be poisonous—*Delphinium bicolor, D. glaucum, D. scopularium, D. azureum*, and *D. penardi*. Larkspur appears to lose its toxic properties as it approaches the flowering period. The best results in treating poisoned animals were obtained from the use of potassium permanganate and atropin. Notes are given on a number of other harmful plants, including a species of rubber plant (*Actinella richardsonii*), water hemlock, death camas, etc.

Eradication of tuberculosis by the methods of Bang and Ostertag with reference to the applicability of these methods to Saxony, J. RICHTER (*Ztschr. Infectionskrank. u. Hyg. Haustiere, 1 (1906), No. 2–3, pp. 187–210*).—Tuberculin tests show that in Saxony about two-thirds of the cattle in the whole kingdom are affected with tuberculosis. The unusual prevalence of this disease makes it necessary to devise a practical method of not too great expense in controlling the disease. As is well known, Bang's method consists in the inoculation of each herd with tuberculin, the separation of healthy and reacting animals into two herds, which must be kept separate thereafter and under the care of different attendants, the rearing of calves on cooked milk, the disinfection of the stables in which the healthy part of the herd is kept, and a repetition of the tuberculin test every 6 months. This method, while effective, has been

found altogether too expensive and too elaborate for application to the average farm. For this reason it is utilized less and less even in Denmark, where government aid is secured in carrying it out. The chief objection to Bang's method is the great increase in the amount of labor necessary to maintain two separate herds on different parts of the farm and prevent infection from spreading from one to the other. Moreover, the repetition of the tuberculin test at frequent intervals has been found to be a considerable hardship. The author believes that Bang's method is practical in localities where only a few herds are affected or in herds where the number of tuberculous animals is not great. In Saxony, however, with two-thirds of the cattle tuberculous, the method is considered quite unpractical.

Ostertag's system of eradication consists simply in the destruction of cattle affected with tuberculosis to such an extent that it may be readily recognized by physical symptoms and the rearing of calves under conditions which prevent infection. This method does not require the separation of the herd into tuberculous and healthy groups, but merely requires, as soon as the disease becomes advanced far enough so that the animals may spread it by coughing or otherwise, that such animals be destroyed. The calves are reared on pasteurized or sterilized milk or on the milk of other healthy cows. While Ostertag's method may not seem to satisfy sanitary requirements so strictly as that of Bang, it is much less expensive, more easily put in operation by the average farmer, and, as experience has shown, almost if not equally effective. The author believes that Ostertag's method is not capable of eradicating tuberculosis, at least within a short time, in a herd without separation of diseased animals, but that it does prevent a further infection and that the method is particularly applicable to the conditions in Saxony.

Experiments with milk artificially infected with tubercle bacilli, E. C. SCHROEDER and W. E. COTTON (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 86, pp. 18*).—Three degrees of infectiousness were artificially produced in milk by adding 1 loop of a culture of tubercle bacilli to 10 cc. of milk from which other degrees of infectiousness were obtained by diluting 10 times and 100 times. Guinea pigs fed on the milk which contained the largest number of tubercle bacilli became infected without exception after feeding on this material 30 days and in $33\frac{1}{3}$ per cent of cases after being fed 1 day. Guinea pigs fed on milk containing a more dilute infection did not become diseased. Evidence was obtained, however, that guinea pigs are not very susceptible to infection with tuberculosis through the alimentary tract.

Hogs were inoculated subcutaneously with cultures of tubercle bacilli obtained from man and animals. In all 12 hogs were used in the experiments. It appears from these experiments that the high susceptibility of guinea pigs to tuberculosis holds good only when infection is made in the abdominal cavity, veins, thorax, or subcutaneous tissue. During the experiments, 52 guinea pigs and 6 hogs were fed on milk containing small quantities of tubercle bacilli, with the result that none of the guinea pigs were affected, while 5 out of the 6 hogs contracted tuberculosis. The experiments indicate clearly that the localization of tuberculosis in the lung gives no hint as to the point at which infection took place. The lung may readily become infected by tubercle bacilli which enter the body at some other point. The authors conclude that the experiments "direct special attention to the danger sustained through exposure to tuberculous material that enters the body with the food. This fact can not be too strongly emphasized."

Behavior of the cows' udder toward artificial infection with human and bovine tubercle bacilli, L. MEYER (*Ztschr. Tiermed., 10 (1906), Nos. 3, pp.*

161–197; 4, pp. 241–276).—An elaborate review is presented of the literature relating to this question in connection with a bibliography of 83 titles. In testing the virulence of tubercle bacilli of different origin, resort is usually had to the subcutaneous, intravenous, and intraperitoneal methods of inoculation. The author chose the method of injection into the udder without producing any lesion. In these experiments three cultures were used, two of human and one of bovine origin. The two cultures obtained from consumptive human patients failed to produce tuberculosis when injected into the udder of cows, and calves which drank the milk also remained healthy. The bovine tubercle bacilli, however, produced a general infection which involved not only the udder but various other organs and tissues and caused infection in the calf which drank the milk.

Tuberculosis of the male genital organs of cattle, J. Kowalewsky (*Rev. Gén. Méd. Vét., 7 (1906), No. 80, pp. 417–419*).—It is stated that in Moscow, tuberculosis of the male genital organs of cattle was only observed in 1 case out of 74,389 which were inspected at slaughterhouses. On account of the unusual rarity of this form of tuberculosis the author gives detailed notes on two cases which came under his observation.

Tuberculin tests, N. O. Nielsen (*Maanedskr. Dyrlæger, 18 (1906), No. 1, pp. 20–25*).—The author undertook the application of the tuberculin test in his neighborhood for the purpose of determining the extent of infection. The results obtained were very satisfactory in so far as the reliability of the test is concerned. In one locality where 68 hogs were fed on the skim milk obtained from a creamery, 29 were found to be tuberculous. A system of pasteurization of the milk was consequently adopted.

Tuberculin and the organism, F. Köhler (*Tuberkulin und Organismus. Jena: Gustav Fischer, 1905, pp. 100*).—The extensive tests which have been reported with tuberculin in cows of different countries throughout the civilized world have led to differences of opinion regarding the reliability of tuberculin, its use for therapeutic purposes, and other matters connected with the general problem of tuberculosis. The author has presented in a brief manner a summary of results obtained by various investigators, the material being arranged under various subheads including chemical investigations, pathology, clinical studies, and therapeutic use of tuberculin. This summary of literature relating to tuberculin makes it apparent that while numerous facts have been worked out with tolerable certainty there still remain many doubtful points for further investigation before positive statements may be made regarding the effect of tuberculin upon the organism.

The demonstration of antituberculin and tuberculous tissue, E. Weil and H. Nakajama (*München. Med. Wchnschr., 53 (1906), No. 21, pp. 1001–1004*).—An attempt was made to determine the specific effect of tuberculin upon tuberculous tissue, and in these experiments active serum was used after being rendered inactive by increasing doses of horse blood. The author believes that the experiments of Wassermann and Bruck proved merely that extractives from tubercle bacilli are found in tuberculous foci. The formation of the complement takes place as a result of a mixture of tuberculin and organic extract. It is believed possible that antituberculin may be present in tuberculous tissue, but this has not been proved. The author discards the theory that complement is formed by a chemical affinity between antituberculin and tuberculin.

The leucocyte and the tubercle bacillus, J. Bartel and W. Neumann (*Centbl. Bakt. [etc.], 1. Abt., Orig., 40 (1906), No. 5, pp. 723–738*).—In the experiments reported in this paper the authors made use of guinea pigs, rabbits, and dogs for inoculation, with an intent to determine the relationship between the leucocyte and the tubercle bacillus. It appears from these experiments that

in the struggle of the infected organism against tubercle bacilli neither the complement nor phagocytosis due to polynuclear and mononuclear cells exercises a decisive rôle. The phagocytosis which appears in a striking manner is largely due to the action of leucocytes found in the lymphatic glands or in other places where lymphocyte cells collect in large numbers.

A special method for cultivating tubercle bacillus on potatoes, J. Anzilotti (*Centbl. Bakt. [etc.], 1. Abt., Orig., 40 (1906), No. 5, pp. 765–768*).—By a combination of potatoes and glycerin, the author found it possible to bring about a more rapid and luxuriant growth of tubercle bacilli than by any other method with which he had experimented. The bacilli thus obtained appeared to remain in an active and virulent condition for long periods, and the virulence of the cultures was in many cases greatly increased.

The tubercle bacillus cultivated in a saccharine medium, L. Vailliant (*Compt. Rend. Soc. Biol. [Paris], 60 (1906), No. 15, pp. 741–743*).—The author added saccharose and glucose to a bouillon medium for the purpose of testing these substances. It appears from these experiments that saccharose and glucose exercise an effect on the amount of chloroform-bacilline produced by the tubercle bacillus.

A method for demonstrating anthrax bacilli in blood and tissues, J. Forster (*Centbl. Bakt. [etc.], 1. Abt., Orig., 40 (1906), No. 5, pp. 751–754*).—A simple method for demonstrating anthrax bacilli has been found in the use of gypsum. After allowing the suspected material to grow for some time on a gypsum rod, cultures are made from this material in order to subject them to microscopic examination. If such cultures are heated to a temperature of 65° C. for 2 minutes, other bacteria such as coli bacillus and proteus will be killed, while the anthrax bacilli will be unaffected.

Protozoan blood diseases of man and animals in German East Africa, A. Treutlein (*München. Med. Wchnschr., 53 (1906), No. 18, pp. 855–857*).—Brief notes are given on the classification of the protozoa which are concerned in the production of blood diseases in man and animals. It was observed during investigations made in the region of Dares-Salaam that organisms resembling trypanosomes were frequently seen in blood preparations in cattle suffering from Texas fever or African coast fever.

Ticks and African coast fever, C. P. Lounsbury (*Agr. Jour. Cape Good Hope, 28 (1906), No. 5, pp. 634–654*).—The investigations of the author regarding the means of transmission of African coast fever have been continued. At first it was believed that only two species of ticks were concerned in transmitting this disease. It has been found, however, that 5 species are implicated—*Rhipicephalus appendiculatus*, *R. evertsi*, *R. simus*, *R. nitens*, and *R. capensis*. Other ticks belonging to different genera apparently have nothing to do in transmitting African coast fever. In the author's experiments it was found possible to transmit the disease by means of one infected tick, but usually more were required. The incubation period averaged 13½ days and the duration of the disease 12 days. As a rule, the animals did not show serious symptoms until within a few days before death. Often it is impossible to transmit the infection by means of the ticks from diseased animals. In 35 cases positive results were obtained, and in all these cases the ticks had become infected in one stage of growth and communicated the disease in the succeeding stage.

Tissue alterations in the cows' udder in cases of sporadic galactophoritis, Van der Linde (*Arch. Wiss. u. Prakt. Tierheilk., 32 (1906), No. 4–5, pp. 337–362, pls. 2*).—Detailed clinical notes are given on 35 cases of this disease. As a result of these studies the author comes to the conclusion that the udder of the cow exhibits a tubular character just before the period of lactation, while

during lactation it is an alveolar gland. Immediately after the close of the period of lactation it again becomes tubular in character. Sporadic galactophoritis appears to be a hypertrophic and polypous chronic catarrh of the udder. The lymphatic glands are enlarged and the catarrh appears to be due to a streptococcus.

A disease of young cattle in county Wexford, A. E. METTAM (*Dept. Agr. and Tech. Instr. Ireland Jour., 6 (1906), No. 3, pp. 460–476, pls. 2*).—For several years a disease has prevailed among young cattle in the county of Wexford and is characterized by chronic diarrhea, emaciation, and finally death. The chief symptom is progressive anemia and emaciation. An examination of the feces and of the intestines, post-mortem, showed the presence of *Strongylus gracilis* and fluke worms. Occasionally the lungs were infested with *S. micrurus*. In advanced cases the yellow marrow in the cavities of the long bones was replaced by red marrow. Various lines of treatment were adopted, such as the use of thymol, coal-tar creosote, carbolic acid, etc., and the feces were examined from day to day to note the effect of treatment. Recovery was brought about by the use of a tonic containing arsenic, tartar emetic, and sulphate of iron as well as by treatment with carbolic acid and turpentine, oil of tar, and thymol. In one case the recovery took place without any treatment. Creosote, lysol, tobacco, hyposulphite of soda, and various other remedies appeared to diminish the number of parasitic worms, but did not bring about a recovery. The author was unable to determine whether the stomach worms were the only cause of the disease. In one instance 28 animals in apparent health were examined and stomach worms were found in the feces of 24 of them. The disease seems, therefore, to be due to an excessive infestation with these worms.

Proliferation of connective tissue in the beef liver in cases of distomatosis, A. JAEGER (*Arch. Wiss. u. Prakt. Tierheilk., 32 (1906), No. 4–5, pp. 456–476, pls. 2*).—The literature of this subject is critically reviewed in connection with a short bibliography. The author describes the various tissue changes which take place in the beef liver after infestation with flukes. A cirrhosis occurs in the form of an induration process, the cause of which is to be sought in the toxic metabolic products produced by the liver flukes in the bile ducts.

A hoof disease occurring in connection with foot-and-mouth disease, SCHENKL (*Wchnschr. Tierheilk. u. Viehzucht, 50 (1906), No. 21, pp. 403–405*).—The author had opportunity to observe a number of cases of hoof trouble which occurred in connection with foot-and-mouth disease. The parts chiefly affected were the crown of the hoof near the cleft and the internal walls of the cleft. The lesions consisted of ulcers in connection with which some proliferation of tissue took place. In a few cases the lesions extended to the bones of the foot. The affected tissue was removed and a thick layer of iodoform sprinkled on the diseased areas. Good results were obtained from this treatment.

Louping ill and braxy, D. J. HAMILTON ET AL. (*Jour. Bd. Agr. [London], 13 (1906), No. 3, pp. 135–142*).—After a long series of experiments the existence of a specific bacillus was found in the exudate of the peritoneal cavity and subsequent tests show that the disease is of a bacterial nature. The organism is apparently taken into the intestines with the food. Much uncertainty has prevailed regarding the nature of braxy. The experiments by the committee appointed to investigate this disease indicate that a number of troubles commonly pass under the name braxy. It is believed that braxy, louping ill, blackleg, and malignant edema belong to the same group of diseases. In fact, the similarity between the symptoms of the louping ill and braxy is so close that confusion often occurs in reaching a diagnosis. It was found that at certain seasons of the year the blood of sheep is quite resistant to the organisms of

both diseases, while at other times it is highly susceptible to their action. The fatal effect of the pathogenic bacteria may, therefore, be prevented in part by drenching the sheep with cultures of these bacteria during the periods of resistance.

Diseases of swine, R. A. Craig (*New York: Orange Judd Co., 1906, pp. 191, figs. 23*).—In view of the agricultural importance of swine raising the literature relating to swine diseases may be considered as too much scattered to be available for practical use by the farmer. The author has attempted in the present volume to bring together the known facts relating to the common diseases of pigs. The subject-matter is discussed under a number of heads, including general, surgical, infectious, and parasitic diseases. Particular attention is given to a thorough discussion of the serious infectious and parasitic diseases of hogs.

The hog-cholera group of bacteria, J. Citron (*Ztschr. Hyg. u. Infectionskrank., 53 (1906), No. 1, pp. 159–175*).—In the author's experiments particular attention was given to a study of agglutinins and aggressins and other bacterial substances contained in the hog-cholera group. It was found that monovalent hog-cholera serum agglutinates the organisms of hog cholera, paratyphoid, and mouse typhoid. The most of the bacteria belonging to this group, when studied in vitro, show a very slight absorptive power for antibodies. While a study of the cultural characters and serum reactions of bacteria of this group indicates a close relationship between the different members, the author nevertheless believes that more study must be devoted to the group before it is safe to consider the organisms of hog cholera, mouse typhoid, and paratyphoid as identical.

Immunization of hogs against swine plague by means of aggressin, E. Weil (*Centbl. Bakt. [etc.], 1. Abt., Orig., 41 (1906), No. 1, pp. 121–125*).—Attention is called to the difficulties which have been experienced in producing immunity against the various forms of hemorrhagic septicemia, to which group swine plague belongs. By means of aggressin, however, many of these difficulties are overcome, and according to the author's experiments excellent results are obtained. It was found in experiments with rabbits that when these animals were immunized against swine plague by a single injection of aggressin obtained from hogs, an immunity was produced which protected them against inoculation with virulent cultures nearly 5 months later. In experiments with hogs it was found that the aggressin in order to be perfectly effective should come from other hogs rather than from rabbits. When rabbit aggressin was used it appeared that 2 inoculations of 10 cc. were enough to protect the animal against a fatal dose of swine-plague culture. It seems that for a short time after inoculation with aggressin and before this material has become effective, the animals are unusually susceptible to swine plague and more likely to take the disease than are those which have not been treated with aggressin.

Intestinal emphysema of hogs, A. Jaeger (*Arch. Wiss. u. Prakt. Tierheilk., 32 (1906), No. 4–5, pp. 410–455, pls. 3*).—Considerable attention has been given to this peculiar condition which is quite often met with in hogs, and no specific cause has heretofore been definitely assigned for it. According to the author's investigations, based on a large number of cases and on the bacteriological study of the tissues involved, this disease must be considered as a local infection in the small intestines, in which the most important processes take place in the lymphatic vessels. The disease is said to be due to a specific organism referred to as *Bacillus coli lymphaticus aerogenes*. Inoculation experiments were made with the organism in question, as a result of which the characteristic vesicles containing gas developed along the walls of the intestines and bacteria were again recovered in pure cultures.

Treatment of tetanus, DESOUBRY (*Bul. Soc. Cent. Méd. Vét., 83 (1906), No. 10, pp. 271–274*).—The author has had considerable experience in treating tetanus, especially in horses, and discusses the effectiveness of different methods. In a recent case of tetanus which occurred in a colt, antitetanus serum was administered intravenously in a dose of 30 cc., together with 10 cc. of tallianin. The treatment was continued for 3 days and diuretin and benzoate of caffein were also given. At first there was improvement, but later serious symptoms recurred. Tallianin was then administered regularly and the animal finally recovered.

Trypanosomiasis of horses in Annam, J. J. VASSAL (*Ann. Inst. Pasteur, 20 (1906), No. 4, pp. 256–295, fig. 1*).—An outbreak of trypanosomiasis occurred near the Pasteur Institute in Annam and was investigated by the author. An account is presented of the distribution of the disease; the symptoms as observed in various cases; inoculation experiments with isolated micro-organisms in rats, guinea pigs, rabbits, and monkeys; and on the pathological lesions observed in affected animals. The author devotes considerable attention to a discussion of the relationship of this disease to surra and comes to the conclusion that it differs somewhat from surra as observed in Inida, Mauritius, and Java by the slighter susceptibility of cattle and the greater virulence of the organism for other animals. On the whole, however, the disease appears to be practically identical with surra.

Horse botflies and their importance in raising colts, KRÖNING (*Ztschr. Veterinärk., 18 (1906), No. 5, pp. 202–211*).—During the past 5 years the author has had occasion to observe many cases of cachexia accompanied with colic in young colts. Notes are given by way of differential diagnosis between botfly disease and chronic anemia, leukemia, pseudoleukemia, infestation with stomach worms and tabes intestinalis. As a result of numerous observations it is concluded that botfly larvæ in large numbers may greatly injure the health of horses. Notes are given on *Gastrophilus equi, G. pecorum, G. hemorrhoidalis,* and *G. nasalis.* The author made special observations on 31 cases of botfly disease in horses. Among this number, 23 young colts recovered after receiving carbon bisulphid in doses of 8 gm. each repeated 6 times.

The army horseshoer, E. A. DOWD ET AL. (*Fort Riley, Kans.: U. S. War Dept., 1905, pp. 84, pls. 22*).—This volume was prepared for use in the school of application for cavalry and field artillery in Fort Riley, Kansas. It contains an account of the anatomy and physiology of the horse's foot, tools used for horseshoeing, methods of shoeing the normal foot, and special methods to confirm or alter certain gaits in the horse as well as an account of disease of the foot. The illustrations are mostly from photographs of army practice in shoeing horses and are of good quality.

The rapid diagnosis of rabies, L. FROTHINGHAM (*Jour. Med. Research, 14 (1906), No. 3, pp. 471–489, pls. 3*).—On account of the recent extensive outbreak of rabies in Massachusetts, the author took occasion to test two of the most generally recognized methods for the rapid diagnosis of rabies. These methods are based on pathological changes in the nerve ganglia and on the presence of Negri's corpuscles. The pathological lesions in the nerve cells, particularly in the plexiform and Gasserian ganglia, are easily demonstrated and, according to the investigations of the author, constitute a source of diagnosis which is fairly accurate. In all cases examined by the author these lesions were presented, sometimes where it was impossible to demonstrate Negri's corpuscles. It was not thought wise, however, to depend entirely on these methods, since in one instance lesions were found in a case which was apparently not rabies.

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The results obtained from Negri's method were always positive in cases where the corpuscles were found and since the method seems to be perfectly reliable to that extent it is considered useless to sacrifice animal life in making inoculations when the corpuscles are found. A detailed tabular statement is presented of the various animals examined and of the findings of Negri's bodies and lesions in the Gasserian ganglia.

The significance of Negri's corpuscles in the diagnosis of rabies, W. ERNST (*Monatsh. Prakt. Tierheilk., 17 (1906), No. 9-10, pp. 453-466, figs. 3*).—The author made a careful study of the nature and occurrence of Negri's corpuscles in animals affected with rabies. As a result of these investigations it was found that in 96 to 99 per cent of the cases of rabies in which clinical symptoms have appeared, intracellular structures are found in the central nervous system which do not appear in healthy animals or in the case of any other disease. The microscopic recognition of rabies by this means is possible even when, on account of decomposition of the material, no help could be expected from inoculation tests. In all cases where Negri's corpuscles are found the diagnosis of rabies is considered perfectly reliable and inoculation tests may be omitted. The diagnosis may be made with a certainty within 3 to 4 hours by means of an embedding method calling for the use of acetone and paraffin. It still remains doubtful whether Negri's corpuscles are a developmental stage of the rabies organism or a product of cell reaction to the disease.

Negri's corpuscles in rabies, N. BALL (*Arch. Vet. Nauk [St. Petersb.], 36 (1906), No. 3, pp. 153-170, figs. 2*).—The literature relating to this subject is critically discussed in connection with a short bibliography. The author presents in a tabular form the results obtained by various investigators in an examination of the brain tissue of rabid animals for the presence of Negri's corpuscles. As a result of the author's study, it is concluded that approximately 96.5 per cent of animals affected with rabies show peculiar structures known as Negri's corpuscles in the nerve cells, particularly in Ammon's horn. In healthy animals or in animals affected with any other disease than rabies, Negri's corpuscles are not to be found in the nerve cells. These bodies, therefore, constitute an excellent means of diagnosis which may be accomplished within 5 to 7 hours after the post-mortem examination of the animal in question. The absence of Negri's corpuscles in the nerve cells of animals suspected of rabies does not exclude the possibility of rabies being present.

The toxin produced by Aspergillus fumigatus, E. BODIN and L. GAUTIER (*Ann. Inst. Pasteur, 20 (1906), No. 3, pp. 209-224*).—From the study of this fungus in cultures and in experimental animals it was found that *Aspergillus fumigatus* produces a toxin which may be rightfully compared with the toxins of bacteria. For the formation of this toxin in cultures it is necessary to have a mixture of protein, especially of the peptone type, and some carbohydrate, especially glucose, saccharose, maltose, or dextrin. The reaction of the toxin must be either neutral or alkaline. The effects of the toxin are chiefly observed in the nervous system and are produced more or less rapidly by the method of inoculation. The symptoms of poisoning from the toxin are muscular convulsions resembling tetanus and leading to death within a few hours if the animal does not recover. The rabbit and dog are very susceptible to the toxin, while the guinea pig, cat, mouse, and white rat are more refractory. The dog and cat are naturally immune to the spores of *A. fumigatus*, but are quite susceptible to the toxin produced by the fungus.

Chicken pox: The forms of chicken pox and their relation to true pox and their micro-organisms. REISCHAUER (*Centbl. Bakt. [etc.], 1. Abt., Orig., 40 (1906), Nos. 3, pp. 356-361; 4, pp. 474-479; 5. pp. 653-683, pls. 2*).—The

common chicken pox, also known as epithelioma contagiosum, has long been known in veterinary science and appears to be distributed throughout the civilized world where fowls are kept. The symptoms of this disease consist essentially in tuberculous exanthema of the skin and specific alterations of the visible mucous membranes. Some fever also accompanies the disease and it is highly contagious. The pathological histology of chicken pox is described in some detail. It appears that in many cases the processes observed in the throat are of a diphtheritic nature and the micro-organisms concerned are perhaps of a saprophytic type which, under certain conditions, penetrate into the living tissue. The micro-organisms found in chicken pox closely resemble those observed in other kinds of pox which affect mammals, and these micro-organisms are distributed in a very similar manner throughout the body. All forms of pox, therefore, seem to be somewhat closely related. Definite statements concerning the relationship, however, can not be made with any safety. A bibliography of this subject is appended to the article.

Cachexia due to Syngamus trachealis in pigeons, R. P. Rossi (*Clin. Vet. [Milan], 29 (1906), No. 4, pp. 73–82*).—An extensive infestation of gapeworms was noted by the author in a colony of pigeons. The gapeworms were occasionally found in the esophagus of young pigeons and obviously young birds became infested through the food given them by the parent birds. Many of the young pigeons died as a result of esophageal infestation. The parasites were frequently observed in the trachea and occasionally in the bronchi of adult pigeons, in which situation they caused a cachectic state and occasionally death by asphyxiation.

RURAL ENGINEERING.

Interstate royal commission on the River Murray, representing the States of New South Wales, Victoria, and South Australia (*Rpt. Comrs. (Sydney), 1902, pp. 359, dgms. 15, maps 12*).—In 1901 there was appointed a royal commission representing the three States of New South Wales, Victoria, and South Australia, whose duty it was to recommend a plan for controlling and utilizing the river Murray, which forms the boundary between New South Wales and Victoria and flows through the territory of South Australia. This commission favors the abrogation of the doctrine of riparian rights and the subordination of navigation to irrigation, but recommends that navigation be maintained by means of locks. It recommends the delivery of a fixed quantity of water from the main stream to each of the three States and a pro rata reduction in case of shortage, and that the torrential tributaries be left to the control of the States in which they are situated. It is recommended further that the carrying out of this agreement be placed in the hands of a special commission to be created by agreement between the three States, the commission holding that this work could not be properly done by the federal officials.

The report gives much interesting information as to present development and the schemes which have been adopted for supplying the capital necessary for the construction of irrigation works. In Victoria the government has built the main canals, and the distributing ditches have been built by local organizations with funds loaned by the government. The report states that in no case have these local organizations lived up to their agreement with the State. In Victoria £1,000,000 out of a total of £1,300,000 of obligations of these associations have been canceled by the State. In New South Wales the works have been built by the government without any provision for the return of the money invested.

In South Australia attempts have been made to provide for the unemployed by settling them upon irrigated tracts, these colonies usually being communistic. None of them has succeeded.

Suggestions for the construction of small pumping plants for irrigation, F. H. NEWELL (*Irrig. Age, 21 (1906), No. 9, pp. 270–274, figs. 5*).—This article outlines the construction of plants adapted to pump water from wells sunk in gravels. The author suggests that such wells should be 12 to 15 in. in diameter sunk into water-bearing gravel 30 to 60 ft., strainers of slotted galvanized iron being provided through the gravel strata. He states that "a 15-in. well drilled in good water-bearing gravel to a depth of 40 ft., the lower 30 of which is strainer surface, should supply at least 300 gal. per minute when the pump lowers the level in the well by 10 ft." For large-size plants the writer recommends arranging a battery of wells in pairs, all being connected to the suction pipe. The arrangement in pairs is for the purpose of removing fine sand from the gravel between the wells, by pumping from one of the pair of wells while running clear water into the other. The inclosed runner type of centrifugal pump, "long sweep" fittings, and internal combustion motors are recommended. For plants of 20 to 30 horsepower the installation of gas-producer plants is advised, since at $8 per ton the cost of coal should be equivalent to gasoline at 4 to 6 cts. per gallon. With regard to the economical height to which water may be lifted, the author considers that "it is very unlikely that it will pay to pump water under present conditions in the valleys of the western plains to a total height of more than 30 ft., including the suction lift of the pump." Data are also given on the cost of pumping and first cost of plants.

Agricultural machinery in the United States (*Landw. Masch. u. Geräte, 6 (1906), No. 12, p. 5*).—In speaking of the economy resulting from the use of machinery in farming operations in the United States, Dr. Laughlin, of Chicago, gave the following figures before a political economy society in Berlin: The sowing of grains which formerly required 10 hours and 35 minutes by hand can now be accomplished in 32.7 minutes by machinery; harvesting and thrashing which required 46 hours and 40 minutes by hand can now be done in 1 hour by machinery. The time required for planting of corn of 6 hours and 15 minutes has, through aid of machinery, been reduced to 37.5 minutes; husking operations requiring formerly 66 hours 40 minutes now require 3.6 hours. The mowing machine performs in 1 hour and 6 minutes what a man with a scythe formerly could accomplish in 7 hours and 20 minutes. Potato planters will now plant as many potatoes in 1 hour and 25 minutes as formerly required 15 hours to accomplish by hand.

Test of American manure-spreading machine (*Maschinen Ztg., 4 (1906), No. 12, pp. 137, 138, fig. 1*).—A discussion of the report on a public test of a manure-spreading machine manufactured in the United States. It is concluded from this test that while the machine does excellent work its value to the farmer is reduced because of its high price and the excessive power required in its operation. It is predicted, however, that it will find extensive use in Germany.

Two tools for the culture of root crops (*Maschinen Ztg., 4 (1906), No. 11, pp. 128, 129, fig. 1*).—One of these is a hoe of special shape provided with markers; the second is a tool for transplanting roots, consisting of an open conical tube, the lower end being sharpened to a cutting edge and a handle being attached to the upper end. The tube is thrust into the ground around the root and the whole plant is removed without disturbing the soil immediately surrounding the root and root hairs. Owing to the conical shape of the tube it is claimed that the operation of withdrawing the tube after the plant is in its new position is comparatively easy.

Plowing by electricity at Dahlwitz (*Maschinen Ztg., 4 (1906), No. 12, pp. 134, 135, figs. 2*).—The apparatus in use here consists of a gang plow which is alternately moved back and forth across the field between two "anchor wagons." By this apparatus about $2\frac{3}{4}$ acres per hour are plowed, and the cost, taking into account all operating expenses and interest on cost of equipment, including power plant, amounts to $0.64 per acre. While it is claimed that the use of the apparatus has proven profitable in this case, it is pointed out that this would not in general be true except probably in those cases where the electric plant could be operated continuously throughout the year, the power generated being put to other profitable uses when not used for plowing.

The windmill in agriculture, C. E. LAWFORD (*Agr. Jour. Cape Good Hope, 28 (1906), No. 2, pp. 200–205, figs. 6*).—After calling attention to the defects in the mills at present being employed in South Africa and elsewhere, the writer urges the following improvements: More rigid and stronger frames, provided with good ladders and large roomy platforms surrounded by railings; a tower cap provided with large rings and burnished-steel balls; a gear head with easily "get-at-able" bearings and a band brake capable of holding the wheel in the highest winds with a minimum power. To increase the efficiency of the mechanism the writer recommends roller bearings in the gear head and a mangle motion in substitution for the usual crank and pitman arrangement. He advises the use of two pumps—one for light breezes and the other for combination with the first in the case of heavy winds. As to oiling devices, he thinks the endless chain or ring oiler the best for solid bearings, and syphon cups with compound, soft-iron wire wicks the best for roller bearings. The writer thinks that "power mills" have certain essential advantages over the usual form, particularly in the efficiency with which the power is transmitted from the wheel to the pump.

The utilization of solar heat for industrial purposes by means of a new plane-mirror reflector, C. GÜNTNER (*Sci. Amer. Sup., 61 (1906), No. 1586, pp. 25409–25412, figs. 6*).—This is a description of a new form of reflector devised by the author, which has certain features radically different from the conical-shaped reflectors of other inventors. His device consists of a series of plane mirrors arranged in a horizontal position and supported by a peculiar link work which is moved to conform to the position of the sun, and which maintains the mirrors in such position that the sun's rays are projected upon a long cylindrical boiler. The latter lies above the mirrors in a horizontal position, with its axis in a north and south direction. The mechanism is such that the mirrors can be turned completely over about their axes as a protection in case of hailstorms. From experiments it was found that a reflector with a surface of 1,000 sq. ft. delivered in 12 hours an amount of energy equal to that generated by the consumption of 4,400 lbs. of hard coal, this being in European latitudes. The inventor estimates that the reflectors can be built at an expense of about $2 per square yard of surface, and predicts that because of its simplicity, cheapness, and effectiveness it will be useful as an aid to pumping operations in arid regions and for other uses in localities where fuel is scarce and sunshine abundant.

Tests of the relative value of crude oil (Beaumont, Texas), kerosene, and gasoline (*New Mexico Sta. Rpt. 1904, pp. 29–31*).

RURAL ECONOMICS.

Rural economy, G. N. LAUMAN (*Cornell Countryman, 3 (1906), No. 9, pp. 211, 212*).—In this article rural economy is tentatively outlined as "that field of knowledge dealing with the facts, deductions, and theories concerning the

economic side of agriculture." The author calls attention to the difference in division of the subject that has taken place in Europe and the United States, and points out that in the latter the agricultural colleges are developing the subject of rural economy rather than that of general economics.

The transition in agriculture, E. A. PRATT (*London: John Murray, 1906, pp. X+354, pls. 10, figs. 2*).—The author shows in this volume the changes which have taken place in English agriculture during the past few years as a result of the decline in cereal production in Great Britain.

As a result of foreign competition, the conservative English farmer has largely given up the culture of wheat and other cereals and is yielding to the advantages of agricultural cooperation in methods of producing, collecting, shipping, and marketing poultry and dairy products, vegetables, fruits, flowers, etc. The opportunities open to the British producer along these lines are shown by the fact that articles of agricultural production, the bulk of which consists of food supplies, were imported into the United Kingdom in 1905 to the value of nearly $1,100,000,000. The author maintains that "though in our circumscribed limits we might not be able to become absolutely self-supporting in regard to all these things, we could certainly produce them for ourselves in greatly increased quantity."

The continued development of British agriculture along the lines of combination and improved marketing conditions, the improvement of the present tenant system, and the further extension of the cooperative allotment of land to factory workers and others near large towns as a means of training for farm and horticultural work and improving their financial condition are earnestly urged upon the attention of the British government, because they "represent the present-day hope of the British agriculturist." To this end the author concludes that the government "should carry out a scheme for the promotion of agricultural education on essentially practical lines; that experimental farms, especially in connection with fruit culture, should be set up in every district where they are likely to be of direct service; that assistance should be given in the setting up of agricultural credit banks; and that a more generous measure of financial support should be extended to the Board of Agriculture and Fisheries with a view to enabling it to increase its powers of usefulness to the agricultural community."

Crop Reporter (*U. S. Dept. Agr., Bur. Statis. Crop Reporter, vol. 8, Nos. 1, pp. 1–8; 2, pp. 9–16*).—These numbers for May and June contain the usual statistical matter on the condition of crops in the United States and foreign countries. Special reports are also included on the beet-sugar production of the United States and Canada; ocean freight rates on cotton; grain crops of the provinces of Alberta and Saskatchewan; outlook for tobacco, 1906; world's international trade in wool; exports of cattle; and other topics.

Cotton production and statistics of cotton-seed products, 1905, W. M. STEUART and D. C. ROPER (*Bur. of the Census [U. S.] Bul. 40, pp. 72, maps 2, dgm. 1*).—In 1905 the total crop of cotton ginned, counting round as half bales, amounted to 10,725,602 bales, of which 10,242,648 square bales and 279,836 round bales were upland cotton, 112,539 Sea Island, and 230,497 bales linters. The average production of cotton for the last 4 years is given as 11,339,323 bales, or 534,767 bales more than in 1905. The production of cotton for several years is given in tables by States and counties and cotton culture in the different cotton-producing countries of the world is described. A table is also given summarizing the cotton-seed products industry, showing capital invested, number of employees, salaries and wages, miscellaneous expenses, cost of materials, and value of products, by States and Territories, for 1890, 1900, and 1905.

Virginia, its forests, minerals, and agricultural possibilities, D. A. WILLEY (*Tradesman, 55 (1906), No. 5, pp. 51, 52*).—The agricultural possibilities in the lines of market gardening and tobacco growing especially are discussed.

How to keep farm accounts, H. L. STEINER (*Toledo, Ohio: Steiner & Co., 1905, pp. 150*).—This book is designed to present a simple form of keeping farm accounts by means of a ledger only. Practical illustrations of making entries, striking balances, etc., are presented.

Farm accounts, J. A. VYE (*St. Paul, Minn.: Author, 1906, pp. XIII + 141, pls. 3, figs. 3, dgms. 47*).—This book is an outgrowth of class-room work and is designed as a manual for the farmer who is desirous of knowing how to keep an accurate account of his business. The entries are made on cards instead of in books, this method being advocated as best for the farmer because of its simplicity and comprehensiveness.

MISCELLANEOUS.

Eighteenth Annual Report of Colorado Station, 1905 (*Colorado Sta. Rpt. 1905, pp. 64*).—This contains a financial statement for the fiscal year ended June 30, 1905; a report of the director on the work of the station during the year; an inventory of the station for 1905; a list of exchanges; and reports of the heads of departments, parts of which are abstracted elsewhere in this issue. The report of the Arkansas Valley field agent contains notes on experimental work with cantaloupes, beets, alfalfa, and corn.

Publications of Colorado Station, 1903-4 (*Colorado Sta. Pubs. 1903-4, pp. 530, figs. 38*).—This consists of Bulletins 77–95 of the station, Press Bulletins 16–23, and the annual report for 1904.

Annual Report of Florida Station, 1905 (*Florida Sta. Rpt. 1905, pp. 5–52*).—This contains a report of the director on the work of the station during the year; a financial statement for the fiscal years ended June 30, 1904 and 1905; departmental reports, some of which are noted elsewhere; and lists of exchanges and publications of the station.

Annual Report of New Jersey Stations, 1905 (*New Jersey Stas. Rpt. 1905, pp. XIX+689*).—This includes the organization lists of the stations; a financial statement of the State station for the year ended October 31, 1905, and of the college station for the fiscal year ended June 30, 1905; a report of the director reviewing the different lines of station work; and departmental reports abstracted elsewhere. Two reports on feeding stuffs have been noted from other publications (E. S. R., 17, pp. 275, 276).

Fifteenth Annual Report of New Mexico Station, 1904 (*New Mexico Sta. Rpt. 1904, pp. 48*).—This contains a financial statement for the fiscal year ended June 30, 1904, and reports of the director and heads of departments, parts of which are abstracted elsewhere in this issue.

Sixteenth Annual Report of North Dakota Station, 1905 (*North Dakota Sta. Rpt. 1905, pp. 55*).—This contains reports of the director and heads of departments on the work of the station during the year 1905, and a financial statement for the fiscal year ended June 30, 1905. The experimental work contained in the report is abstracted elsewhere.

Digest of the work of the Ploti Agricultural Experiment Station for the decade 1895–1904, A. A. BICHKHIN ET AL. (*Srod Rabot Plotyanskoĭ Selsko-Khozyaĭstvennoĭ Opuitnoĭ Stantziĭ. Odessa, 1905, pp. XV+294, figs. 9*).

NOTES.

Arizona Station.—G. E. P. Smith, irrigation engineer, has inaugurated an investigation into the amount, availability, and value of the underground water supply in a representative arid-region valley. The station has instituted work in vegetable physiology and pathology, and W. B. McCallum, Ph. D., of the University of Chicago, has been selected to have charge of this work. He will enter upon his duties about January 1, and will take up the study of certain plant diseases peculiar to the region. Edward E. Free, a recent graduate in chemistry at Cornell University, has been appointed assistant chemist.

California University.—The title of M. E. Jaffa has been changed from assistant professor of agriculture to assistant professor of nutrition.

Connecticut College and Storrs Station.—W. M. Esten has succeeded W. A. Stocking, jr., as dairy bacteriologist in the college and station.

Delaware College and Station.—Harry Hayward has accepted the position of director of the station and professor of agriculture in the college. He will assume his duties October 1.

Florida University and Station.—C. M. Conner has resigned as agriculturist and vice-director, to accept the position of agriculturist in the North Carolina College. W. R. Clothier of Kansas has been appointed to succeed him as agriculturist.

Indiana Station.—C. O. Swanson has resigned as assistant chemist to accept a similar position at the Kansas Station. L. S. Hasselman, a graduate of Purdue, class of '06, has been added to the chemical department as assistant chemist. C. O. Cromer, a graduate of Purdue, class of '06, has been appointed assistant agriculturist. H. N. Slater, dairy field assistant, has been appointed expert in the Dairy Division of this Department, in charge of extension work in dairying in Texas. G. I. Christie has been transferred from assistant in crop improvement to associate in charge of agricultural extension.

Iowa College and Station.—J. A. McLean, in charge of animal husbandry at the Colorado College and Station, has been elected assistant professor of animal husbandry in the college and assistant animal husbandman in the station, to succeed W. J. Rutherford, resigned. E. T. Robbins, assistant in animal husbandry in the college, will hereafter devote all of his time to station work as assistant in animal husbandry. M. E. McCulloch, E. Humbert, and L. C. Burnett have been elected assistants in the farm crops department. The poultry department recently established at the college has been placed in charge of H. C. Pierce, of Ithaca, N. Y. M. L. King, a graduate of the mechanical engineering department of Iowa State College, has been elected exprimentalist in agricultural engineering.

An agricultural extension department has been organized, with P. G. Holden as superintendent. He will have a corps of six or seven assistants, who will be specialists in the subjects of animal husbandry, soils, dairying, farm crops, horticulture, and domestic science. The total staff in the division of agriculture, including the instruction staff, the experiment station, and the extension work, will number 41 this year.

The funds from the Adams Act and increased State appropriations have enabled a more clearly defined distinction between the experimental, instructional, and extension work than has formerly been the case. Thirteen of the members of the staff will devote their time exclusively to station work. Eight of the members of the instruction staff will devote their time exclusively to instruction work. The heads of departments will have the general direction of the work in both lines, but the assistants are in most cases assigned definitely to one field or the other.

Kansas College and Station.—C. W. Burkett, of the Ohio State University, has been elected director of the station, and entered upon the duties of his position September 1. C. O. Swanson, assistant chemist of the Indiana Station, has been elected assistant chemist, his term of service beginning September 1. W. E. Mathewson, assistant in chemistry in the college and station, has resigned his position and will spend the next year or two in study. C. W. Melick, assistant in dairying for the past two years, has resigned to accept a position at the Maryland College and Station.

Special trains for the improvement of wheat growing were run through the wheat belt over the Atchison, Topeka and Santa Fe Railway and Union Pacific Railway during August. The trains were provided by the railroads, and the other expenses were borne by them to a large extent. Meetings were held in the coaches during the day and at halls in the evening where practicable. Much interest was taken by the farmers in these meetings, and it is believed that they will be of material benefit to the wheat growers.

Maryland Station.—P. M. Novik, of Cornell, has been appointed assistant in the horticultural work under the State appropriation. George P. Weldon, of Fort Collins, Colo., has been appointed assistant entomologist and assigned to the State work. F. H. Blodgett, assistant botanist and pathologist, has been granted one year's leave of absence, and E. I. Lichti, of Columbus, Ohio, has been appointed to fill this vacancy. V. M. Shoesmith, now associate agronomist at the Kansas Station, has been appointed agronomist of this station, to take effect January 1, 1907. This work has been carried on by Professor Taliaferro, who in the future will confine himself to college work. W. N. Hutt has resigned the position of horticulturist to accept a similar place in North Carolina. His resignation takes effect November 1.

Massachusetts College and Station.—Clark Hall, the new botanical building provided for by the last session of the legislature, is now in process of erection. The appropriation for the building is $45,000. It will be 45 by 95 ft. in dimensions, and two stories in height above a basement, and with an attic which will contain several good rooms. The base will be of granite and the rest of the building of red brick with marble trimmings. The roof will be of copper and slate. The building will be of slow-burning construction, and special provision will be made in the construction of the desks and other laboratory fittings to avoid fire hazard.

The last State legislature appropriated $5,000 for normal work at the college, as a result of the report of the industrial commission, made last summer. The exact character of this work has not yet been determined upon, but it is planned to promote agricultural instruction in the elementary grades. The State industrial commission is continued, with Prof. Paul H. Hanus, of Harvard University, as chairman, and it is hoped that the above appropriation will be only a beginning of a new line of work at the college.

Montana College and Station.—Dean B. Swingle, for several years connected with the Bureau of Plant Industry of this Department, has been appointed assistant botanist in the station. A greenhouse 22 by 50 ft. has been con-

structed, at a cost of about $1,000, for use in connection with the botanical work of the college and station.

Nevada University and Station.—N. E. Wilson, for 15 years chemist of the station, and more recently in charge of the chemical work of the university, has been granted a two-years' leave of absence. He will be the manager of a large wholesale and retail drug business, with an analytical laboratory connected. Dr. Maxwell Adams, a graduate of Stanford University, assumes his work as professor of chemistry in the university, and S. C. Dinsmore, assistant chemist, will have charge of the station work.

New Hampshire College and Station.—F. W. Rane, horticulturist in the college and station, has resigned to accept the position of State forester of Massachusetts, with headquarters at Boston. The former forester, Alfred Akerman, resigned during the summer to accept a position elsewhere.

New York State Station.—W. E. Tottingham, assistant chemist, has resigned his position to become instructor in agricultural chemistry at the University of Wisconsin. H. J. Eustace, assistant botanist, has accepted a position in the Bureau of Plant Industry, this Department.

Oklahoma College and Station.—F. C. Burtis has resigned his position in charge of animal husbandry, and has been succeeded by W. F. McDonald, of Teeswater, Canada. L. A. Moorhouse has returned from a year's leave of absence and taken charge of the department of agronomy.

Rhode Island Station.—Leon J. Cole, Ph. D., of Harvard University, has been appointed chief of the division of animal breeding and pathology. W. F. Purrington, of the New Hampshire College, and H. S. Hammond, of the Ontario Agricultural College, have been appointed assistant chemists in the station.

A new horticultural building and greenhouse is being built with a State appropriation of $15,000. Accommodations for station work will be provided in one wing of the greenhouse.

Virginia Station.—Seymour M. Herrick, a graduate of Cornell University, has been appointed assistant chemist. Cooperative arrangements have been made between the U. S. Department of Agriculture, the State board of agriculture, and the Virginia Station, for work in the trucking region of the State. The new agricultural hall is nearing completion. Arrangements have been made for the construction of two large fermentation cellars, which will be artificially refrigerated, for the purpose of studying the production of vinegar and other fermented products of the apple.

Washington Station.—H. R. Watkins, instructor in chemistry at the Kansas College, has been appointed assistant chemist in the station.

West Virginia Station.—The death is reported of A. L. Post, assistant bacteriologist in the station.

Experiment Station for Economic Botany in Sweden.—The establishment of a botanical experiment station near Landskrona, Sweden, is noted in the *Scientific American.* This station, named Esperanza, which has been established by a bequest of Oscar Ekman, is intended solely for investigations of an economic nature, such as the cultivation of medicinal, pigment, and fiber plants. The station was dedicated in July and consists of a museum and experimental fields. Two directors have been appointed, Tom von Post, a practical botanist, formerly director of the seed-control station at Upsala, and author of the Lexicon Generum Chanerogamarum, and Hjalmar Lindström, in charge of the pharmaceutical side of the work.

Bacteriological Laboratory at Rothamsted.—On July 19 at the Rothamsted Experiment Station occurred the formal opening of a new laboratory erected and partially endowed ($250 a year) by J. F. Mason, M. P., in memory of his

father, the late James Mason, of Eynshan Hall, Oxon, who for many years conducted on his own estate extensive experiments on the influence of leguminous crops on fertility. The new laboratory is said to be the only one in England devoted exclusively to the study of agricultural bacteriology.

Agricultural Education at the American Institute of Instruction.—The seventy-sixth annual convention of the American Institute of Instruction was held at New Haven, Conn., July 9–12. In the department of rural education the papers and discussions were devoted largely to the subject of elementary agriculture. Hon. Walter E. Ranger, commissioner of public schools in Providence, and Mr. Frank F. Murdock, principal of the North Adams, Mass., Normal School, discussed The Significance of the Report of the Massachusetts Commission on Industrial Education. Hon. Mason E. Stone, superintendent of education of Vermont, and Dr. William P. Brooks, of the Massachusetts Agricultural College, considered the subject Have the Principles of Agriculture a Legitimate Place in the Curricula of the New England Public Schools? The School Garden as an Instrument of Sound Education was the subject of a paper by W. H. Baldwin, principal of the State Normal School at Hyannis, Mass., and The Preparation of Teachers for School Garden Work was presented by H. D. Hemenway, of Westchester, Conn.

California Polytechnic School.—A new two-story domestic science building, 42 by 103 feet, is just being completed. It contains on the first floor an office and reception room, 2 sewing rooms with adjoining cloak room, closets, and fitting room, a lecture room and a class room for classes in botany with adjoining office and herbarium. On the second floor are the kitchen, laboratory, pantry, butler's pantry, lockers, dining room, office, 2 class rooms (one for bookkeeping), and rest room.

Agricultural High Schoils in Georgia.—The last general assembly of Georgia passd a law establishing 11 Congressional agricultural high schools as branches of the State College of Agriculture, to be under the general supervision of the board of trustees of the University of Georgia. Each school will receive for maintenance an equal share of the inspection fees collected by the State department of agriculture not otherwise appropriated, amounting as now estimated to about $6,000 a year, but the different localities in which the schools are located must furnish not less than 200 acres of land and the necessary equipment. The course of study will be limited to the English branches, agriculture, farm mechanics, and such other studies as will admit a boy to the freshman class of the State College of Agriculture. It is contemplated that the boys will perform all the work on the farms and about the school property, and will receive wages from the proceeds of the farms.

New Agricultural High Schools.—The school board of Cecil County, Md., has decided to open this fall an agricultural high school at Calvert, in the northern part of the county, and has engaged Mr. H. O. Sampson, of this Department, as superintendent and teacher of agriculture. The recent legislature of the State passed an act requiring agriculture to be taught for at least one year during a child's connection with the public schools, and this subject will appear in the next manual of studies issued by the State superintendent of public instruction.

A new high school has been opened at Petersham, Mass., with a course in agriculture. Edwin H. Scott, a graduate of the Massachusetts Agricultural College, is instructor in that department. Much interest has been exhibited in the provision of this new course, which was equipped in advance of any other department in the school.

Marinette County, Wis., is erecting a building for a new agricultural high

school patterned after those already in operation in Dunn and Marathon counties.

The high school at St. Louis, Mich., has introduced a three-year agricultural course. The agricultural work begins in the second year and runs through both terms of the second and third years, the following topics being considered: The soil—origin, drainage, and capillary action; the plant—food, propagation, and diseases; orchard, garden, and field; farm animals, dairying, and gardening.

New Haven Meeting of the American Veterinary Medical Association.—The American Veterinary Medical Association held its forty-third annual meeting in Harmonie Hall, New Haven, August 21 to 24. About 150 members were present, and a still larger number of visiting veterinarians and others attended the sessions.

A special feature of the meeting was the unusual interest shown in the improvement of veterinary education in the United States by raising the standard of entrance requirements in veterinary schools, improving the curricula in these institutions, and standardizing so far as possible the veterinary degree. An association of veterinary faculties and veterinary examining boards has been formed from the members of the general association, and this branch association has undertaken seriously the work of improving veterinary education. Reports were received from men who had personally inspected all veterinary schools in the United States and Canada, and specific features of these institutions were approved or disapproved according to the manner in which they met the requirements laid down by the association.

On the whole, it appeared that there is much encouragement along this line, since definite improvement was shown in a number of educational institutions and in the work of the veterinary examining boards of the different States. The defects of the systems in vogue in different localities were thoroughly discussed and suggestions made for improvement during the coming year.

W. H. Lowe in his presidential address referred to the good showing made by the meat-inspection service in the recent agitation, and recommended that the association give all possible help to the improvement of the veterinary organization of the Army, veterinary education, and veterinary journalism in the United States.

C. J. Marshall, in his report as chairman of the committee on intelligence and education, considered particularly the educational value of veterinary hospitals. In order to make a thorough study of cases of animal diseases it is necessary to have the patients under closer observation than is possible in ordinary private practice. The reports of stock raisers on the condition of animals during treatment can not be relied upon very fully, since such men do not observe closely all the symptoms which appear during treatment.

In the reports furnished by resident State secretaries it appeared that rabies has prevailed to an unusual degree in Connecticut; hog cholera is rapidly passing under control in Kansas; a flourishing veterinary association has been established in Kentucky; vaccination against bovine tuberculosis is progressing satisfactorily in Pennsylvania; tick eradication is being pushed forward in Tennessee; Government support to the veterinary service is satisfactory in Cuba and Hawaii; milk sanitation has been put on a good basis in Massachusetts; veterinary education is improving in Illinois, but the Chicago system of milk inspection is insufficient.

P. A. Fish discussed the properties of arecolin hydrobromid. This is an alkaloid from the areca nut, and in doses of 1 to 6 grains in horses causes salivation, perspiration, or purgation. A dose of one-tenth of a grain in the eye causes contraction of the pupil. Large quantities administered hypodermically

may produce respiratory paralysis. It appears to have no vermifuge effect, but is recommended for laminitis and azoturia. One of the most marked effects of the drug is to lower the blood pressure.

V. A. Moore and W. J. Taylor discussed the agglutination method in the diagnosis of glanders. The method is considered very useful in doubtful cases. The process takes place even with dead glanders bacilli, and mallein does not interfere with the reaction. In general, a reaction is obtained in dilutions of 1 : 1,000–2,000, while in the case of nonglanderous serum a reaction will not take place in a dilution greater than 1 : 500.

G. H. Berns reported that in a test of the agglutination method in 152 cases the results were confirmed in all except one case.

The control of glanders in the Dominion of Canada was discussed by J. G. Rutherford. When the Dominion government first took up the control of tuberculosis reacting horses were held in quarantine and subsequently tested with mallein in the hope that some of them might cease to react or become cured. This method has been abandoned, however, in favor of the one of slaughtering all glanderous horses whether showing visible symptoms of glanders or not. The reason for the change of policy lies in the fact that reacting but nonclinical cases of glanders were found to be fruitful sources of spreading contagion.

W. H. Dalrymple, in a paper on insect enemies, referred to the importance of mosquitoes, ticks, tsetse fly, and horseflies in transmitting animal and human diseases. A number of other biting insects may be concerned in the transmission of diseases and at least contribute to a considerable loss of condition in animals.

A. Loir referred to his recent experience in South Africa and elsewhere in diagnosing rabies by means of Negri's corpuscles. The author's experince indicates that wherever Negri's corpuscles are found a reliable diagnosis of rabies may be reached, but that the absence of corpuscles does not necessarily exclude the possibility of rabies being present.

A. T. Peters described a spraying method for the control of cattle mange. In Nebraska and elsewhere cattle mange was first treated by hand, after which dipping was inaugurated on a large scale in 1900. A spraying machine has now been devised which, in the author's opinion, is more effective than any dipping system. The cattle are driven through a chute where they receive the spray from all sides simultaneously. The machine can be set up anywhere on the range, and the cattle therefore do not have to be driven long distances to be treated. It will spray from 800 to 1,000 cattle per hour, and any dip can be used, although a 25 per cent mixture of crude oil and water is preferred.

R. Ebbitt gave the results of his study on tuberculosis in swine, which appears most commonly in a glandular or scrofulous form. The author has observed more tuberculosis in swine than in cattle, and believes this is not all due to the use of creamery by-products, but rather to feeding tankage. The last idea, however, was combated by a number of other members in discussion.

S. H. Ward, in a paper on Tuberculosis in Cattle, stated that mammary tuberculosis is very rare and that inhalation is not the main source of the disease. Most cases appear to be of intestinal origin. The retropharyngeal glands were found to be affected in 60 per cent of cases.

C. H. Jewell gave an account of the veterinary service in the Army. At present there are 30 veterinarians in the cavalry service and 12 in the artillery service. Some improvements are needed in the service such as would be obtained by giving the veterinarians a regular military footing and the retirement privilege. The service also needs more hospitals.

A. Peters discussed the problems of city milk supply. Statistics were given showing the amount of milk used in various cities, and attention was called to the general awakening of the public to the importance of supervision of city milk. Veterinary inspection is needed everywhere, and in all localities where it has been introduced good results have followed.

W. L. Williams described the surgery of roaring. The surgical treatment for roaring has been fairly well perfected since 1845, but the technique has been much improved recently. Different operators have different methods, such as removing the arytenoid cartilage, the vocal cords, or the proliferating tissue in this region.

T. Butler presented a brief statement of the present status of tick eradication in the South. The problem is considered a national one, and the interest and support of northern veterinarians were solicited. In North Carolina 11 counties have been freed from ticks.

S. E. Weber referred to the possible agency of insects in carrying tubercle bacilli and other pathogenic organisms. It was stated that insects may carry tubercle bacilli in human sputum, and the Psocidæ are believed to be particularly concerned in this transmission.

The clinic held on the last day of the meeting was of unusual interest and included a number of cases of roaring, neurotomy, quittor, dentigerous cyst, and other cases.

The following officers were elected for the ensuing year: President, J. Law; vice-presidents, J. G. Rutherford, W. T. Monsarrat, L. A. Merillat, E. B. Ackerman, and H. Jensen; secretary, R. P. Lyman; and treasurer, G. R. White.

Miscellaneous.—Dr. H. Marshall Ward, F. R. S., professor of botany at Cambridge University, died August 26 at the age of 52 years. Dr. Ward was a well-known writer upon diseases of plants, and had given special attention to those affecting timber trees.

The death is reported of Dr. E. von Freudenreich, director of the Bacteriological Laboratory of the Swiss Agricultural Experiment Station, at Liebefeld, near Bern, and widely known for his contributions to dairy bacteriology. His death occurred August 22.

F. S. Earle, director of the Central Experiment Station of Cuba since its organization, has resigned his position.

A. J. Pieters, of the Bureau of Plant Industry of this Department, has resigned to engage in commercial seed growing in California.

J. van Leenhoff, formerly of this Department, has been appointed tobacco expert and chief of the tobacco division of the Transvaal Department of Agriculture.

It is announced that an international conference on the selection and introduction of useful plants will be held at Paris in the near future.

The Forest Service of this Department has recently established a laboratory in Boston, Massachusetts, for the purpose of making investigations and experiments in the manufacture of chemical wood pulps. The principal object of the laboratory is (1) to test the pulp-making possibilities of woods other than spruce to see if a substitute can not be found for this wood in paper making, (2) to find other fibers that may have properties peculiarly adapted to special kinds of paper making, and (3) to see if a pulp of marketable value can not be obtained from the waste material in sawmill and lumbering operations.

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NOTE.—The publications of the United States Department of Agriculture, except those of the Weather Bureau, may be purchased from the Superintendent of Documents, Washington, D. C. For the publications of the Weather Bureau, requests and remittances should be directed to the Chief of the Bureau. The price of the Record is $1 per volume, or 10 cents per number. The prices of other technical publications are given in the list above. The publications of the State experiment stations are distributed from the stations and not from the Department.

EXPERIMENT STATION RECORD.

VOL. XVIII. OCTOBER, 1906. No. 2.

The address of Mr. James J. Hill upon "The future of American agriculture" has attracted wide attention and comment in the public press. It was a notable address, showing thorough familiarity with the improvident and wasteful methods that have characterized much of our farming, and a full realization of impending dangers to the future well being—not of agriculture merely, but of all industry. It was a powerful appeal for a greater degree of intelligence in farming operations and for placing the art on a more enlightened and conservative basis.

Coming from a man of national reputation as a shrewd and far-seeing business manager and promoter, and presenting facts with a vividness that startles, the address commands respect and enforces thoughtful consideration. It is this, rather than the originality of the views advanced, which has served to attract public attention and lend to it an influence which the conclusions of a less prominent man would not have had.

It is a hopeful sign when a man of great business interests is able to recognize the economic value of scientific work to agriculture and to appreciate the importance of the conservative methods it has taught. When such a man is willing to pause long enough in his work of promotion and development to sound a note of warning that arouses attention from coast to coast, agricultural experimentation is conscious of having gained a strong ally and received a marked impetus. Such a champion is worth much to the cause.

Mr. Hill's intelligent appreciation of the problems of agricultural production and the teachings of scientific study and experimentation was no surprise to those who have known him. This was to be expected of a man who has taken sufficient interest in the establishment of a substation in Minnesota to give three-quarters of a section of land for it, who has lent his support to the movement for agricultural schools in that State which resulted in favorable legislative action, and who has carried thousands of farmers to the agricultural colleges and experiment stations of Minnesota and North Dakota especially, free of charge or at nominal fare, that they might see the work done there and be placed in position to profit by it.

The keynote of Mr. Hill's address was the maintenance of soil fertility as the rightful heritage of posterity. The necessity and far-reaching importance of doing this was enforced as it rarely has been before. In a striking way he showed the fundamental dependence of all industry upon the soil, the source not only of food, but of wealth to support manufactures. "All the life that exists upon this planet, all the development of man from his lowest to his highest qualities, rest as firmly and as unreservedly upon the capacities of the soil as do his feet upon the ground beneath him." All industry must stop, he explains, when the products of the soil are not forthcoming to furnish the money for the pay rolls.

He characterizes the soil as "the one unfailing national resource, . . . the sole asset that does not perish because it contains within itself, if not abused, the possibility of infinite renewal." But he points out that in utter disregard of these facts the waste of this treasure "has proceeded so far that the actual value of the soil for productive purposes has already deteriorated more than it should have done in five centuries of use." He quotes the late Professor Shaler as saying that "of all the sinful wasters of man's inheritance in the earth, and all are in this regard sinners, the very worst are the people of America," and shows that nowhere is this reckless disregard of future needs exemplified in a more marked degree than in the treatment of our soils. "There is," he says, "except in isolated and individual cases, little approaching intensive agriculture in the United States. There is only the annual skimming of the rich cream, the exhaustion of virgin fertility, the extraction from the earth by the most rapid process of its productive powers, the deterioration of life's sole maintenance. . . . Except in isolated instances, on small tracts here and there farmed by people sometimes regarded as cranks, and at some experiment stations, there is no attempt to deal with the soil scientifically, generously, or even fairly."

The effect of this depletion of fertility is illustrated by the statistics of production and the low return in money value from an acre of land. He points to sections where everything has been taken away and nothing given back, and where, owing to the wasteful methods, a condition has already resulted in which "agriculture as an independent industry, able in itself to maintain a community, does not exist." He shows that while the yield of wheat in the favored wheat-producing areas in the Northwest has fallen from an average of 25 bushels an acre to 12 or 15 bushels, the production of other countries has steadily increased and fertility been built up at the same time. "The French now draw from the soil more than five times as much wealth as they did a century and a half ago."

Some startling figures are presented to show the inadequacy of our present production in the face of a rapidly increasing population. It

is estimated that at the present rate of growth this country will have a population of 130,000,000 less than twenty years hence, and that within forty-four years we shall have to meet the wants of more than 200,000,000 people. It is stated as a mathematical fact that within twenty years, under present conditions, our wheat crop will not be sufficient for home consumption and seed, without leaving a bushel for export.

These facts were presented, not in the spirit of the pessimist, but to enforce the necessity for action which will check the present tendency and prevent further damage. Diversification in farming was urged—the practice of rotation of crops, of stock raising, and of more intensive tillage, which will make our lands more productive while it maintains their fertility; and with this done it was concluded that our possibilities would be equal to the demands. "If not another acre were to be redeemed from the wilderness," he says, "if the soil were treated kindly and intelligently, and if industry were distributed duly, and popular attention were concentrated upon the best possible utilization of the one unfailing national resource, there would be produced all necessary food for the wants of, in round numbers, 650,000,000. But this means such study and labor to raise production to its highest terms as have entered scarcely at all as yet into the American comprehension."

The remedy, Mr. Hill suggests, lies in agricultural experimentation and popular demonstration. "Let the zeal for discovery, for experiment, for scientific advancement that have made the last century one of multiplied wonders, focus themselves upon the problems of the oldest of sciences and arts." Let the Government establish model farms in every rural Congressional district, "later perhaps in every county in the agricultural States," in order to illustrate better methods of farming to maintain fertility. "Let the Department of Agriculture show exactly what can be done on a small tract of land by proper cultivation, moderate fertilizing, and due rotation of crops."

Whether or not we agree with the exact form which this relief should take, we must agree that the remedy lies along the lines of agricultural experimentation to furnish the basis for reform, and of popular instruction and demonstration to bring the facts forcefully before the people. And all will agree with his assertion that there must be "a readjustment of national ideas such as to place agriculture and its claims to the best intelligence and the highest skill that the country affords in the very fore front."

The problems of soil fertility are foremost at many of our experiment stations at the present time, and a considerable share of the projects planned to be investigated under the Adams fund center around this subject. The fundamental importance of the subject is

not underestimated, but the difficulties in studying so complex a question are very great.

In this connection the presidential address of Dr. E. B. Voorhees, before the American Chemical Society at the Ithaca meeting last summer,[a] is timely and instructive. It deals with Some Problems for Agricultural Chemists, which it shows require the cooperation of other branches of science as well. It makes some specific suggestions for lines of investigation which are fundamental in character and are greatly needed at this time to answer the questions of practical men. As indicating the difference between such fundamental investigation and isolated experiments, and as showing something of the method of attack, the address is excellent.

One of the problems proposed is the ultimate effect of the continued use of commercial fertilizers. It is pointed out that in some cases a condition has resulted from using large quantities of commercial fertilizers which makes the soil less responsive or less adapted to certain crops. This effect may be assigned to various causes—chemical, physical, biological, etc.—but in the speaker's opinion we have as yet nothing definite and positive to answer. The question is a very live and important one, and grows in large measure out of the system of fertilization which has been recommended.

Another problem relates to the decline in productive capacity of soils under cultivation, especially in the richer sections—that is, the loss of fertility. This may be explained in part as due to imperfect chemical or physical or bacteriological conditions of the soil, or of all of these combined, but it is urged that we should not deal in probabilities, and we do not yet know the measure of the effect of these various factors. We must find out what the cause of the apparent exhaustion is, be able to show the farmer what his sources of loss are, and suggest a remedy.

The importance of humus in relation to fertility is another subject mentioned which needs investigation. Notwithstanding all the investigations that have been made, the speaker expressed his conviction that much remains to be learned as to the function of this constituent and the manner of the influence it exerts in maintaining and improving fertility of soils. "We are unable from our present knowledge to state whether the effect is physical, chemical, or biological, or whether it is a combined effect of each, or whether it is absolutely essential that the organic matter be present in large amounts in order that the best results may be obtained. It is a problem well worthy of the attention of our agricultural chemists, and one which must be solved if we are to give safe advice as to the cultivation of our soils."

The nitrogen question, the maintenance of the proper supply in the soil and prevention of losses, is also pointed to as one of far-

[a] Published in Science, n. ser., 24 (1906), No. 613, pp. 385–390.

reaching importance to agriculture, and the application to this end of nitrogen assimilation from the air by certain plants. "We have many instances of attempts made to improve soils or to maintain their fertility by the introduction of leguminous crops, which have proved disastrous rather than helpful in promoting plant growth or of permanently increasing fertility in this respect. Furthermore, we have no definite knowledge as yet as to the conditions which are necessary in order that the plants shall appropriate nitrogen from the air rather than from the soil, nor have we any definite information as to how large a proportion of the nitrogen so gathered is retained in the soil for the use of cereal and other crops which depend entirely upon soil sources for their nitrogen."

The supplying of fertilizing elements other than nitrogen is also a question for the near future, in view of the present heavy demands upon the known supplies of these materials. While there is sufficient supply of these in the soil to last for certain kinds of crops for centuries, under conservative management, it is pointed out that there is a class of crops—such as vegetables, fruits, berries, etc., the demand for which is rapidly increasing—which "can not be grown to perfection and in such quantities as to meet the demands of a modern civilization without the stimulating effect of immediately available plant food." The increasing demand for these fertilizing elements, the speaker held, could not be supplied by natural means, including the use of homemade manures, and hence the source of supply of phosphate and of potash salts furnishes a broad field for study.

Another problem, economic in character, has to do with the transfer of the plant food elements from one place to another, and their loss in so far as our own country is concerned. "There is no doubt but that by careful adjustments of trade conditions it will be possible to obtain quite as much money for our surplus products as is obtained at the present time without having the practice result in so great an annual loss of our plant-food constituents."

It will be seen that in a large measure these two addresses dealt with the same great agricultural problem, but from somewhat different points of view—the one enforcing the need of checking the rapid depletion of soils in fertility, in view of the fundamental importance of the soil to all industry and the rapidly increasing population; the other by analyzing the subject and suggesting lines of research upon which to base methods for greater conservation of this fertility and increased agricultural production. In conclusion Doctor Voorhees emphasized the importance of a broad and detailed study of the whole question of soil fertility, and his belief that "there is no field of investigation more promising of fruitful results for the investigator and the country at large."

One of the greatest needs in investigation along this line is to deal with the subject in its different phases, rather than to consider it for purposes of research in extenso. Soil fertility in itself is not a project. It is a grand division of agriculture embracing a score, perhaps hundreds, of projects. And if we are to learn anything more about soil fertility than that it is the ability to produce crops, and more about its maintenance than the calculated amounts of nutrients removed and the fertilizing constituents needed to make good this draft, we must separate this great subject into its different phases and prosecute the individual research along narrow lines.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

On the determination of water-soluble and total phosphoric acid in superphosphates, K. Rohm (*Chem. Ztg., 30 (1906), No. 44, pp. 542, 543; abs. in Analyst, 31 (1906), No. 365, p. 275; Jour. Chem. Soc. [London], 90 (1906), No. 525, II, p. 490; Chem. Centbl., 1906, II, No. 2, p. 163*).—"*Water-soluble phosphoric acid.*—A number of determinations were made on 3 samples to compare the method in which the sample is digested with water for 2 hours, with occasional shaking, with that in which it is agitated continuously with water for 30 minutes in a shaking machine, different speeds being also tested. The most constant results are given by the latter method, the speed being about 30 to 40 rotations per minute, but digesting the sample without any shaking at all gave results only about 0.2 per cent too low (with 19 per cent of water-soluble P_2O_5). The sample used should pass through a 2 mm. mesh sieve.

"*Total phosphoric acid.*—Extraction with nitric acid, with a mixture of nitric and sulphuric acids, and with aqua regia, gave practically identical results. Extraction with hydrochloric acid, which is never used in practice, gave results about 0.2 per cent too low. The magnesia precipitate should be allowed to stand 24 hours before filtering, or else mechanically stirred for 30 minutes. On allowing it to stand for only 2 hours, an error of up to 0.22 per cent of P_2O_5 was found in a number of analyses."

Investigations on the causes of error in the application of the citro-mechanical method to the determination of phosphoric acid in natural phosphates and phosphatic slags, E. Guerry and E. Toussaint (*Bul. Agr. [Brussels], 22 (1906), No. 3, pp. 315–349; Bul. Soc. Chim. Belg., 20 (1906), No. 5–6, pp. 167–203*).—Studies are reported which lead to the conclusion that the errors referred to are due to the presence of fluo-silicates and to a deficiency of iron salts as compared with silica in solution. The author proposes to eliminate the errors due to these causes by removing the fluorin by treatment with sulphuric acid and by adding iron salts before precipitation according to the following method:

To 2.5 gm. of the material in a 250 cc. Jena glass flask add 10 cc. of concentrated sulphuric acid and heat over wire gauze until acid fumes begin to appear, allow to cool, adding water carefully until the volume has reached about 100 cc., then add 25 cc. of aqua regia and boil for 10 minutes on a sand bath, cool, make the volume to 250 cc., and filter. To 25 cc. of the filtrate add in the case of natural phosphates 5 to 10 cc. of a 2 per cent solution of ferric chlorid, neutralize partially with ammonia, cool if necessary, and add 30 cc. of citrate solution with 15 cc. of ammonia and 35 cc. of magnesia mixture, shake for ½ hour, filter after allowing to stand for 1 hour, wash, ignite, and weigh.

The author uses either Peterman's alkaline citrate or a solution containing 500 gm. of citric acid neutralized with a slight excess of ammonia and made to

a volume of 2 liters. In case of the latter solution 40 cc., corresponding to 10 gm. of citric acid, is used.

The separation of silicic acid in the determination of citric-acid soluble phosphoric acid, J. Hasenbäumer (*Chem. Ztg., 30 (1906), No. 53, pp. 665, 666; abs. in Chem. Centbl., 1906, II, No. 6, p. 556*).—Investigations with a number of different kinds of Thomas slag are reported which show that the higher results obtained when silicic acid is not previously removed from the solution are not due to the presence of this substance in the precipitate, and indicate that the discrepancy may be due either to the carrying down of a certain amount of phosphoric acid in the gelatinous silicic acid when this is removed before precipitation or to the fact that the precipitate obtained after removal of the silicic acid is different in composition from that produced before such removal.

The use of compressed air in analysis of superphosphate, G. Schliebs (*Chem. Ztg., 30 (1906), No. 47, p. 584*).—Good results are reported in the substitution of agitation by means of a stream of compressed air in place of mechanical agitation.

The determination of potash in potash salts and mixed fertilizers by the Neubauer modification of the Finkener method, M. Kling and O. Engels (*Ztschr. Analyt. Chem., 45 (1906), No. 5–6, pp. 315–332; abs. in Analyst, 31 (1906), No. 365, pp. 273, 274; Chem. Centbl., 1906, II, No. 4, p. 360*).—The authors have used the following modification of the Finkener-Neubauer method with satisfactory results:

Dissolve 10 gm. of the potash salt in 500 cc. of water, and to 25 cc. of this solution, corresponding to 0.5 gm., add a few drops of hydrochloric acid, the necessary platinum chlorid, and evaporate to dryness in a porcelain dish. Take up with water and alcohol as in Neubauer's method, collect on a Neubauer-Gooch crucible, wash with alcohol, and dry by placing the crucible on a moderately hot metal plate.

Reduce the platinum salt in a current of coal gas, heating for the first 10 minutes over a very low flame, and finally at a faint red heat for 20 minutes. When reduction is complete heat the crucible for 2 minutes over the naked flame of a Teclu burner, wash the contents of the crucible about 15 times with hot water and 2 or 3 times with cold 15 per cent hydrochloric acid, immerse the crucible to about three-quarters of its height in nitric acid of the same strength in a porcelain dish, cover the dish with a clock-glass, heat for about 30 minutes on the boiling water-bath and allow to cool. Finally wash the platinum in the crucible with hot water and alcohol, ignite, and weigh.

In case of mixed fertilizers, shake 20 gm. of the sample with 800 cc. of water for 30 minutes in a liter flask, make up to the mark, and filter. To 100 cc. of the filtrate, corresponding to 2 gm., add ammonia and ammonium carbonate in a 200 cc. flask, make the volume to 200 cc., and filter and evaporate 50 cc., corresponding to ½ gm. of material to dryness in a platinum dish. Dry the residue, drive off ammonium salts, and ignite to fusion, taking up the fused residue with hot water and a little hydrochloric acid. Filter if there is an insoluble residue. Add platinum chlorid solution (2 cc. of a 10 per cent solution is usually sufficient), evaporate to dryness, and determine potash as described above.

The accuracy of the method was tested by a number of determinations and it was shown that the presence of phosphates does not interfere with the determination. A table for calculating the amount of potash from the weight of platinum obtained from 0.5 gm. of substance (factor=0.48108) is given.

On the determination of potash by means of platinum hydrochlorid in the presence of sulphates of the alkalis and alkaline earths, K. Regel (*Chem.*

Ztg., 30 (1906), No. 55, pp. 684, 685; abs. in Chem. Centbl., 1906, II, No. 6, p. 558; Analyst, 31 (1906), No. 366, p. 813).—The author employs a modification of Fresenius's so-called short method, in which the potassium platinum chlorid is reduced by means of nascent hydrogen and the separated platinum is weighed.

In the method proposed the solution of the potash salt is evaporated directly with platinum chlorid without previous precipitation with barium chlorid. The potassium platinum chlorid obtained is treated as directed by Fresenius, being washed from the filter into a small beaker and the particles remaining on the filter dissolved in hot water. An excess of magnesium powder is added and the solution gently heated. The precipitate of platinum is collected on a filter and any excess of magnesium is removed by washing with dilute hydrochloric acid. The platinum is then dried, ignited, and weighed.

If magnesium and calcium sulphate are present these are removed by washing with 5 per cent nitric acid. It is stated that in a series of tests of the method results were obtained which agreed well with those yielded by the Fresenius and Finkener-Neubauer methods.

A few observations on elementary analytical determination of ash, F. von Konek (*Chem. Ztg., 30 (1906), No. 46, pp. 567, 568; abs. in Chem. Centbl., 1906, II, No. 7, p. 631*).—By combining ash determination and analytical combustion in one operation the ash content is always higher than by ordinary incineration. By heating the ash obtained in the combustion in the air the weight is reduced to that obtained in ordinary determinations. The difference is said to be due to incomplete dissociation of carbonates of alkalis and alkaline earths, to the variation in volatility of the alkaline salts, and to various minor causes which are enumerated.

Estimation of carbon in soils and kindred substances, A. D. Hall, N. H. J. Miller, and N. Marmu (*Jour. Chem. Soc. [London], 89 (1906), No. 522, pp. 595–597, fig. 1*).—The authors tested Wolff's method of determining organic carbon by oxidizing with a mixture of chromic and sulphuric acids, and found that while this method in its original form gave results which were much too low, by the addition of a short tube containing red-hot copper oxid to complete the combustion the whole of the carbon in the soil could be obtained as carbon dioxid. The carbon dioxid evolved is absorbed in dilute caustic alkali in a Reiset tower and determined by double titration with phenolphthalein and methyl orange, as suggested by Hart.

A method of determining hydrogen peroxid and ferrous salts and other reducing agents, W. E. Mathewson and J. W. Calvin (*Amer. Chem. Jour., 36 (1906), No. 2, pp. 113–117*).—The yellow compound formed by the action of hydrogen peroxid upon soluble titanium compounds is instantly decomposed by reducing agents. The authors have utilized this fact in devising a method for determining reducing agents by titrating against a standard solution of hydrogen peroxid and vice versa, a titanium salt being used as an indicator. The results reported in this paper were obtained with ferrous ammonium sulphate and sodium nitrite.

On the Polenske method for the detection of cocoanut oil in butter, S. Rideal and H. G. Harrison (*Analyst, 31 (1906), No. 365, pp. 254–260, fig. 1*).—This method (E. S. R., 15, p. 850) depends upon the relation of the insoluble to the soluble volatile fatty acids, which the authors do not find to be as constant in pure English butters as was found by Polenske.

For pure butter obtained from different localities in England during June and July the Polenske numbers varied from 1.6 to 2.15. Samples taken fortnightly from the same dairy for nearly a year showed variations from 1.2 to 2.75. The average Reichert-Meissl and Polenske numbers for the pure English butters

were, respectively, as follows: Two samples 27.88 and 1.33, 2 samples 28.70 and 1.53, 7 samples 29.36 and 1.77, 8 samples 30.44 and 2, 7 samples 31.52 and 2.10, 3 samples 32.43 and 2.37, and 1 sample 34.55 and 2.15.

The authors find, however, that when cocoanut oil is added to a pure butter fat the relative increase in the insoluble acids agrees practically with the results obtained by Polenske. An increase of 1 in the Polenske number over that of a genuine butter having the same Reichert-Meissl number indicates the addition of 10 per cent cocoanut oil, the minimum quantity that can be detected by this method.

In no case did the samples of margarin examined give a higher Polenske number than 1. Cheese fats showed the same ratio of insoluble to soluble fatty acids as in the case of butter.

The determination of fat in milk powder and cream cheese, H. Haupt (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 4, pp. 217–221*).—The author favors the Gottlieb-Röse method. In 4 milk powders the fat content as determined by this method was, respectively, 17.33, 17.86, 28.55, and 28.84 per cent and by ether extraction 17.16, 17.40, 28.48, and 28.99 per cent. A sample of Parmesan cheese showed a fat content of 26.85 per cent by the Gottlieb-Röse method and 26.28 per cent by ether extraction for 10 hours. Corresponding results were obtained with Emmenthal, Edam, Gorgonzola, and Camembert cheese.

Proceedings of the twenty-second annual convention of the Association of Official Agricultural Chemists, held at Washington, D. C., November 16, 17, and 18, 1905, edited by H. W. Wiley (*U. S. Dept. Agr., Bur. Chem. Bul. 99, pp. 211, figs. 2*).—This is the official report of the proceedings of the convention. A summarized account of the meeting has been given (E. S. R., 17, p. 423), and a circular of the Bureau containing extracts from the proceedings noted (E. S. R., 17, p. 834).

Cooperative work on fats and oils, Association of Official Agricultural Chemists, 1906, L. M. Tolman (*U. S. Dept. Agr., Bur. Chem. Circ. 27, pp. 6*).—This contains the provisional method for the titer test adopted by the association in 1905 and a differentiation of the "cold test" and the "cloud test" as a basis for further cooperative work.

Provisional methods for the determination of food preservatives as authorized by the Association of Official Agricultural Chemists, 1905 (*U. S. Dept. Agr., Bur. Chem. Circ. 28, pp. 13, fig. 1*).—This circular contains the changes and additions to the provisional methods for the analysis of foods published as Bulletin 65 of the Bureau so far as they relate to preservatives.

Changes in provisional methods for the analysis of foods and additions thereto, from 1902 to 1905 (*U. S. Dept. Agr., Bur. Chem. Circ. 29, pp. 20*).—Owing to the impracticability of revising Bulletin 65 of the Bureau it has been thought best to compile the additions to and changes in the methods given in that bulletin which have been authorized by the Association of Official Agricultural Chemists and to suggest at the next convention a plan for the revision of all the methods.

Changes in official methods of analysis and additions thereto, 1899 to 1905 (*U. S. Dept. Agr., Bur. Chem. Circ. 30, pp. 28*).—It has been found impracticable to incorporate the changes and additions authorized by the Association of Official Agricultural Chemists to the official methods of the association as published in Bulletin 46 of the Bureau of Chemistry, so this and the three circulars noted above, giving a compilation of the authorized changes and additions, have been issued for the purpose of presenting the present status of the methods in order that the subject of revision may be acted upon by the association at its next convention.

METEOROLOGY—WATER.

Report of the Chief of the Weather Bureau, 1904–5 (*U. S. Dept. Agr., Weather Bur. Rpt. 1904–5, pp. XXIV+384*).—Part 1 of this report contains a review of the last 10 years' work of the Bureau and an account of the work of the year (E. S. R., 17, p. 734); part 2, a list of observing stations and changes therein during 1904, and twice-daily observations for 30 selected stations, 1904; part 3, monthly and annual meteorological summaries for 180 stations; part 4, monthly and annual means and extremes of temperature and dates of first and last killing frosts, 1904; part 5, monthly and annual precipitation, 1904; and part 6, miscellaneous meteorological tables and reports.

Monthly Weather Review (*Mo. Weather Rev., 34* (*1906*), *Nos. 3, pp. 109–156, figs. 13, charts 7; 4, pp. 157–200, pls. 2, charts 7*).—In addition to the usual reports on forecasts, warnings, weather and crop conditions, meteorological tables and charts for the months of March and April, 1906, recent papers bearing on meteorology, recent additions to the Weather Bureau library, etc., these numbers contain the following articles and notes:

No. 3.—Structure of Hailstones, by E. S. Webster; Studies on the Thermodynamics of the Atmosphere—III, Application of the Thermodynamic Formulæ to the Nonadiabatic Atmosphere (illus.), by F. H. Bigelow; German Aerial Research Station; A New Departure in Forecasting; Atmospheric Effects in Astronomical Observations; The Eighth International Geographic Congress; The Legitimate Line of Duty; The Tornado at Meridian, Miss., March 2, 1906 (illus.), by L. A. Denson; The Opportunities of the Weather Service; Drought and Atmospheric Electricity; Severe Hailstorm at Pensacola, Fla., by W. F. Reed, jr.; A Peculiar Temperature Fluctuation (illus.), by W. Upton; Halos of March 1–4, 1906 (illus.); Weather Bureau Men as Educators; Kite Flight of April 5, 1906, at Mount Weather Observatory (illus.), by O. L. Fassig; Where are the Old Records of Haiti; The Zodiacal Light (illus.), by M. Hall; and The Zodiacal Light—Is It Meteorological or Astronomical.

No. 4.—Note on Evaporimeter, by B. F. E. Keeling; The Nephological Review; Storm and Hurricane Insurance in the West Indies; Cloud Banners; The Indexing of Marine Reports; The Publication of the Chicago Memoirs; The Warmth of December, 1905; Style of Meteorological Publications; Cosmic Relations of the Atmosphere; The Province of the Monthly Weather Review; Diurnal Variation of the Barometer; Influence of the Ocean on Continental Precipitation; Pressure and Rainfall over the Indian Monsoon Area; Vincent's Bibliography of Treatises on Meteorology; Meteorology in Egypt; The Colors of Dust-haze; Can We Argue from the Climate Back to the Orography? Krakatoa Dust *versus* Krakatoa Vapor; The Convection Theory of Whirlwinds; A Method of Predicting the Movement of Tropical Cyclones, by M. Hall; On the Conditions Determining the Formation of Cloud-spheres and Photospheres, by A. W. Clayden; Theory of the Rainbow, by W. LeC. Stevens; Weather Bureau Men as Educators; and Mr. R. F. de Grain.

Meteorological observations, J. E. OSTRANDER and T. A. BARRY (*Massachusetts Sta. Met. Buls. 209, 210, pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during May and June, 1906. The data are briefly discussed in a general note on the weather of each month.

Meteorological observations, W. T. ELLIS, W. T. MACOUN, R. ROBERTSON, W. S. BLAIR, S. A. BEDFORD, A. MACKAY, and T. A. SHARPE (*Canada Expt. Farms Rpts. 1905, pp. 28, 91, 263, 301, 321, 356, 357, 400, 401, 438*).—Summaries are given of observations on temperature, precipitation, etc., during 1905 at

Central Experimental Farm, Ottawa; Nappan, Nova Scotia; Brandon, Manitoba; Indian Head, Northwest Territories; and Agassiz, British Columbia.

Meteorological chart of the Great Lakes, A. J. HENRY and N. B. CONGER (*U. S. Dept. Agr., Weather Bur., Met. Chart Great Lakes, 1906, No. 1, pp. 20, pl. 1*).—This is a summary of observations on the meteorological conditions of the winter of 1905–6 in the lake region, with notes on ice on the Great Lakes winter of 1905–6, opening of navigation for the season of 1906, and display of storm warnings on the Great Lakes. Lists of stations and location of flagstaffs and steel towers, and Canadian Great Lakes storm-warning stations are also given.

Well waters from farm homesteads, F. T. SHUTT (*Canada Expt. Farms Rpts. 1905, pp. 154–157*).—Of the 83 samples of water of which analyses are given "22 were reported as safe and wholesome, 38 seriously polluted, 12 suspicious and probably unsafe for drinking purposes, and 11 saline in character."

Fluctuations of the water level in wells, with special reference to Long Island, New York, A. C. VEATCH (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 155, pp. 83, pls. 9, figs. 17*).—This bulletin contains a report of observations made on the fluctuation of the water level in wells, both with direct reading and self-recording gages, in connection with an investigation of the geology of Long Island by the Geological Survey in the summer of 1903, and also a general discussion of the fluctuation of water in wells.

Some of the results of this study may be briefly summarized as follows:

"(1) The most important and characteristic of the natural ground-water fluctuations is the regular annual period. This is a relatively uniform curve, with a single maximum and minimum, on which the fluctuations of shorter periods, as a rule, form but minor irregularities. This curve does not generally resemble the rainfall curve. Were the rainfall uniform throughout the year, the ground water would still show a regular yearly period and the maximum would occur early in the year in the North Temperate Zone. The effect of irregularities in the rainfall is to move the time of occurrence of this maximum either forward or back.

"(2) The water from single showers is generally delivered gradually to the ground-water table and, even where noticeable fluctuations are produced, these do not commonly make important irregularities in the regular annual ground-water curve.

"(3) Single showers may, by transmitted pressure through the soil air, produce instantaneous and noticeable rises in the water in wells and notably increase the stream discharge without contributing either to the ground water or directly to the surface flow.

"(4) The amount contributed to the ground water can not be satisfactorily estimated by the rise and fall of the water in wells, because the same amount of rainfall under the same geologic and climatic conditions, in beds of the same porosity, will produce fluctuations of very different values. Near the ground-water outlet the total yearly range may be but a few inches, while near the ground-water divide it may be 50 or 100 ft. When an attempt is made to calculate the amount of water received from single rains, the results are not reliable, because in the cases which are usually taken, such as sharp, quick rises, it is impossible to tell how much of the rise is due to transmitted pressure and how much to direct infiltration.

"(5) Because of the increase in stream flow due (1) to transmitted pressure from rains, (2) to changes in barometric pressure, and (3) to increase in area of ground-water discharge, with the elevation of the ground-water table, it is not possible to correctly separate the quantity of water in the stream discharge

contributed by spring flow from that contributed by direct surface run-off. There are many reasons for believing that in humid regions 'flood flows' contain large percentages of ground water.

"(6) Tidal fluctuations in wells are very often produced by a plastic deformation due to the loading of the tides, and the occurrence of such fluctuations in wells does not in itself indicate a connection between the water-bearing strata and the sea.

"(7) Temperature changes may produce marked fluctuations (1) by changes in capillary attraction—such fluctuations are perceptible only at the surface of the zone of complete saturation, are not transmitted to deeper levels, and vary directly with the temperature; (2) by changes in viscosity or rate of flow—fluctuations due to this cause vary inversely with the temperature, and show in deep wells by transmitted pressure."

The geology and water resources of the eastern portion of the Panhandle of Texas, C. N. Gould (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 154, pp. 64, pls. 15, figs. 4*).—This report summarizes field observations during 1903 and 1904 on topography, geology, water resources (underground, springs, streams, also drainage and irrigation) in general and by counties for an area of approximately 10,800 square miles, lying in the northeastern part of the Texas Panhandle, and including the counties of Lipscomb, Ochiltree, Hansford, Hutchinson, Roberts, Hemphill, Wheeler, Gray, Carson, Armstrong, Donley, and Collingsworth, each of which is approximately 30 miles square.

As regards the future of irrigation in the region the report says: "Taking into account the local facts it seems very doubtful if there will ever be any extensive irrigation in the region under discussion. The supply of water is not sufficient for this purpose except along the larger streams, where the conditions are such that dams can not be constructed. Small streams, springs, artificial ponds, and wells supply water for limited irrigation, sufficient often to raise vegetables and fruit for a family, but not more. As time goes on and the region is more thickly settled, these small plants will increase in number.

"There is little to warrant the hope that the water supply in the Panhandle will ever increase, and unless some more efficient means than the ordinary windmill be secured to lift the water from deep wells to the surface it is extremely improbable that anything like extensive works can ever be installed. On the other hand, it is obvious that only a very small part of the available water is now being utilized. It is possible that the future will witness in this region thousands of small pumping plants, each capable of supplying sufficient water to irrigate a garden and an orchard."

Preliminary report on the geology and underground waters of the Roswell artesian area, New Mexico, C. A. Fisher (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 158, pp. 29, pls. 9*).—The area to which this report relates is located in southeastern New Mexico. It comprises about 1,800 square miles lying along Pecos River and extending from a point 5 miles north of Roswell to below the mouth of Seven Rivers.

In addition to the discussion of the artesian waters, the report includes a brief description of the geology of the sedimentary rocks, their structure, and their relation to the underground waters. The area of flowing wells is indicated and records of representative wells are given, which are intended to illustrate the character and succession of the water-bearing beds. Information respecting surface waters available for domestic and irrigation purposes and a brief description of the climatic and agricultural features of the region are also given.

"The climate of the Roswell basin does not differ materially in the prevailing aridity from that of the remainder of southern and eastern New Mexico. The

temperature of the region is high, with a low relative humidity. The summers are usually long and hot and the winters mild and pleasant. The maximum temperature is 110° and the minimum seldom falls far below zero. . . . The average annual precipitation at Roswell is 16.6 in. The greater part of this amount falls during the months of June and July in frequent showers, which, although often violent, are generally local and of short duration. Only a small percentage of the annual precipitation falls as snow. . . .

"The general aridity of the climate renders farming without irrigation impracticable except in a few low-lying areas adjacent to Pecos River. In consequence agriculture is restricted to those portions of the valley where water can be obtained from some of the various canals or from artesian wells. The cultivated portions of the basin at present comprise about one-eighth of the total area included in this report, the remainder being utilized for pasturage of cattle—an industry to which the higher lands are well adapted. . . .

"It is believed that there is no cause for fear that the water supply throughout the northern part of the Roswell basin will give out or become inadequate for all requirements under proper economy of practice. In the region of Artesia and McMillan not enough wells have been sunk to indicate the amount that the water-bearing beds may be expected to yield. There is pressing need for greater economy on the part of the users of well water throughout the Roswell basin."

SOILS—FERTILIZERS.

Soils, A. M. Peter and S. D. Averitt (*Kentucky Sta. Bul. No. 126, pp. 63–126*).—This bulletin discusses methods and uses of soil analysis, reports analyses of 127 samples of soils from different parts of Kentucky, and gives the results of a comparison of 3 methods of determining humus in soils and a study of the causes of error in determinations of this substance by the method of the Association of Official Agricultural Chemists. The unsatisfactory character of methods of soil analysis for practical purposes is pointed out, but the uses which can be made of results obtained by these methods are indicated.

Results are reported which indicate that the official method for humus in soils gives results which are much too high. The author proposes to approximately eliminate the error by "deducting from the apparent weight of humus 10 per cent of the weight of the residue remaining after burning off the humus."

The determination of humus in portions of the humus solution corresponding to 1 gm. of soil by boiling with potassium permanganate solution (3 gm. of salt to 1 liter of water) gave results which agreed fairly well with the determinations by the official method corrected as described. An attempt to use a colorimetric method with the nitric-acid solution of the residue obtained by evaporating the humus solution to dryness did not give satisfactory results.

The chemical investigation of Tennessee soils, C. A. Mooers (*Bien. Rpt. Tenn. Dept. Agr., 1903–4, pp. 147–154*).—This paper discusses briefly what constitutes fertile soil, the importance of the mineral constituents of plant food and the best proportion of these constituents in soils, and the need and value of chemical investigation of the soils of Tennessee.

Mechanical analysis of soils (*Jour. Agr. Sci., 1 (1906), No. 4, pp. 470–474*).—The method adopted by the chemical committee of the Agricultural Education Association is described and the general principles of the method are discussed. The method is as follows:

"(1) Ten gm. of the air-dry earth which have passed a 3 mm. sieve are weighed out into a porcelain basin and worked up with 100 cc. of fifth-normal hydrochloric acid, the acid being renewed if much carbonate of lime is present. After

standing in contact with the acid for 1 hour the whole is thrown upon a dried, tared filter, and washed until free of acid. The filter and its contents are dried and weighed. The loss represents hygroscopic moisture and material dissolved by the acid.

"(2) The soil is now washed off the filter with dilute ammoniacal water onto a small sieve of 100 meshes to the linear inch, the portion passing through being collected in a beaker marked at 10, 8.5, and 7.5 cm., respectively, from the bottom. The portion which remains upon the sieve is dried and weighed. It is then divided into 'fine gravel' and 'coarse sand,' by means of a sieve with round holes of 1 mm. diameter. The portion which does not pass this sieve is the 'fine gravel.' This should be dried and weighed. The difference gives the 'coarse sand.' If required, both these fractions can also be weighed after ignition.

"(3) The portion which passed the sieve of 100 meshes per linear inch is well worked up with a rubber pestle, and the beaker filled to the 8.5 cm. mark and allowed to stand 24 hours. The ammoniacal liquid which contains the 'clay' is then decanted off into a Winchester quart. This operation is repeated as long as any matter remains in suspension for 24 hours. The liquid containing the 'clay' is either evaporated in bulk, or measured and, after being well shaken, an aliquot portion taken and evaporated. In either case the dried residue consists of 'clay' and 'soluble humus.' After ignition the residue gives the 'clay,' and the loss on ignition the 'soluble humus.'

"(4) The sediment from which the 'clay' has been removed is worked up as before in the beaker, which is filled to the 10 cm. mark and allowed to stand for 100 seconds. The operation is repeated till the 'fine sand' settled in 100 seconds is clean, when it is collected, dried, and weighed.

"(5) The turbid liquid poured off from the 'fine sand' is collected in a Winchester quart, or other suitable vessel, allowed to settle, and the clear liquid siphoned or decanted off. The sediment is then washed into the marked beaker and made up to the 7.5 cm. mark. After stirring, it is allowed to settle for 12½ minutes, and the liquid decanted off. The operation is then repeated as before till all the sediment sinks in 12½ minutes, leaving the liquid quite clear. The sediment obtained is the 'silt,' which is dried and weighed as usual. The liquid contains the 'fine silt' which, when it has settled down, can be separated by decanting off the clear liquid, and dried and weighed.

"(6) Determinations are made of the 'moisture' and 'loss on ignition' of another 10 gm. of the air-dry earth. The sum of the weights of the fractions after ignition plus loss on ignition plus moisture plus material dissolved in weak acid should approximate to 10 gm.

"(7) It is advisable to make a determination of the 'fine gravel' in a portion of 50 gm. of the air-dry earth. The soil should be treated with acid, as in 1, and after that is removed by decantation may be at once treated with dilute ammonia and washed on the sieve with 1 mm. round holes. The 'fine gravel' left on the sieve is then dried and weighed, and the percentage found should agree with that found in 2. If it does not the result now found should be taken as the true one."

Agricultural reconnaissance of the Uinta Indian Reservation, W. W. McLaughlin (*Utah Sta. Bul. 93, pp. 23*).—The area covered by the reconnaissance reported in this bulletin includes approximately 650,000 acres of agricultural land situated in the Uinta Basin about 105 miles east of Heber and 90 miles northeast of Price, Utah. The general conditions are described and data are given relating to climate, water supply, and soils.

It is stated that the soils of the upper part of the benches are more desirable than those of the river bottoms, which frequently contain injurious amounts of

alkali. The upper lands require more frequent and larger applications of irrigation water than the lower lands. The water supply is sufficient for all tillable lands. The climate is equable during the greater part of the year but variable in spring and fall, although there is no extreme weather and winter grazing of stock is practicable. There is some danger from frost on the upper lands. Arid or dry farming will probably not be successful on account of the very low precipitation, varying from 6 to 14½ in. at different places in the reservation for the whole year and from 1.23 to 2.95 in. for the 3 months June to August.

The changes in cultivated soils, A. MERCIER (*Bul. Soc. Chim. Belg., 19 (1906), No. 8–9, p. 267; abs. in Rev. Gén. Agron., n. ser., 1 (1906), No. 2, pp. 56, 57*).—The author concludes from his studies that digestion with hydrochloric acid of 1.18 sp. gr. does not furnish any information of practical value as to the fertility of the soil. In comparative tests of normal and tenth-normal hydrochloric acid for this purpose the conclusion was reached that the normal acid is the strongest which should be used for studies of this kind.

The author concludes that all of the fertilizing material assimilable by plants is removed in the first half liter of solution with acid of this strength when 250 gm. of soil is used for extraction. The material removed by further treatment is merely an indication of the changes in the soil. The apparatus used in the extraction with acid is described.

The amount and composition of the drainage through unmanured and uncropped land, Barnfield, Rothamsted, N. H. J. MILLER (*Jour. Agr. Sci., 1 (1906), No. 4, pp. 377–399, figs. 4*).—In this article a brief account is given of the Rothamsted drain gages and the results obtained with them since their establishment in 1870 are summarized. There are 3 of these drain gages 0.001 acre in area, extending to depths of 20, 40, and 60 in., respectively.

The annual averages for the 35 years, 1870 to 1905, were as follows: Rainfall 28.97 in.; drainage—20-in. gage 13.84 in., 40-in. gage 14.61 in., 60-in. gage 13.65 in.; drainage per cent of rain—20-in. gage 47.8, 40-in. gage 50.4, 60-in. gage 47.1; evaporation—20-in. gage 15.13 in., 40-in. gage 14.36 in., 60-in. gage 15.32 in.

"The rain supplies annually to the soil about 5 lbs. of nitrogen. Of this amount about 4 lbs. represent nitrates and ammonia which would be rapidly nitrified in the soil, and the rest, about 1 lb., represents organic compounds which may be either more or less readily nitrified than the organic nitrogen of the soil. In any case the total amount is very small as compared with the amounts found in the drainage through the soil of the gages.

"During the last 28 years the average loss of nitrogen in the gages has been 31.4 lbs. per acre per annum. The annual losses vary from year to year considerably, partly owing to differences in the rainfall and partly to the distribution of the rain. There is, in addition . . . a slight tendency for the nitrates to decrease, but this only manifests itself when successive averages of several years are compared. The yearly amounts of nitrogen in the drainage of the 60-in. gage have varied from 61 to 15 lbs. with the highest recorded rainfall in 1878–9 (41.05 in.) and the lowest rainfall in 1897–8 (19.51 in.). Both years were preceded by years of high rainfall. In 1898–9 when the rainfall was, for a second year, unusually low, the 60-in. gage lost nearly 31 lbs. of nitrogen; and in 1899–1900 nearly 38 lbs. The very low results of 1897–8 are partly due to the complete washing out to which the gages were subjected the year before, when the 60-in. gage lost 41.4 lbs. of nitrogen. It is probable, however, that the 19 years between the maximum and minimum losses have helped to increase the difference."

The average annual amounts of chlorin found in the drainage water during 28 years of observation were as follows: In the drainage water of the 20-in.

gage 14.84 lbs. per acre, of the 40-in. gage 15.89 lbs., of the 60-in. gage 14.64 lbs. For the 28 years there has apparently been a gain of 8.68 lbs. per acre for the 20-in. gage, a loss of 20.72 lbs. for the 40-in. gage, and a gain of 14.28 lbs. for the 60-in. gage.

A list of 10 references to articles relating to this subject is given.

The relation between lime content of soils and plants, A. KADGIEN (*Fühling's Landw. Ztg., 55 (1906), No. 9, pp. 310–316*).—The lime content of a large number of Prussian soils is compared with that of various crops grown on the soils. In the opinion of the author so many conditions influence the lime content of the plant that this can not be taken as a reliable index of the lime content of the soil. The advantages of liming, particularly when other manures are liberally used, are discussed.

On the lime factor for flax and spinach, S. NAMIKAWA (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 57–60, fig. 1*).—Pot experiments are reported which indicate that a lime-magnesia ratio in the soil of 1 : 1 is the most favorable for the growth of these crops.

Some analyses of natural humus compounds, E. MICHELET and J. SEBELIEN (*Chem. Ztg., 30 (1906), No. 31, pp. 356–358*).—Analyses of typical samples of humus from 10 different sources, leaf mold, peat, soils, etc., are reported in full, showing wide variations in the composition of the humus from the different sources. Further studies of the behavior of the humus when treated with alkaline solvents, etc., are contemplated.

The control of soil moisture in orchard soils, F. T. SHUTT (*Canada Expt. Farms Rpts. 1905, pp. 133–137*).—In continuation of previous work (E. S. R., 17, p. 119) two series of experiments, each comprising 3 plats, were instituted at the experimental farms, Ottawa, in 1905 (1) to ascertain the moisture content of soil under a thick mulch of straw as compared with that of a soil constantly cultivated and uncultivated soil; and (2) to learn the relative moisture content of soils under hairy vetch, tares, and constant cultivation.

A series of experiments were also conducted on the experimental farm, Nappan, N. S., on 6 plats "to contrast throughout the season the moisture content of soil (1) bearing an oat crop; (2) carrying a second season's growth of clover (with timothy) and harvested; (3) similar to 2, but with the growth cut from time to time and used as a mulch; (4) cultivated till June 15, then sown with crimson clover; (5) cultivated till July 20, then sown with crimson clover; (6) cultivated until July 20, then left undisturbed."

On account of the ample and well-distributed rainfall at Ottawa the differences in moisture content under the different methods of treatment were not very large. In the experiments at Nappan, however, where the rainfall was deficient, the beneficial effect of cultivation in conserving soil moisture was very strikingly demonstrated.

The variation of land and water temperatures, W. F. COOPER (*Rpt. Mich. Acad. Sci., 7 (1905), pp. 40–43*).—This paper reports the results of a series of observations on land and water temperatures on the west side of Saginaw Bay and east of Tobico Bay, northwest of Bay City. These show the average water temperature during the period of observation (August, 1904) to be 72.11°, that of the land 72.38°.

Calcium sulphate in aqueous solutions: A contribution to the study of alkali deposits, F. K. CAMERON and J. M. BELL (*U. S. Dept. Agr., Bur. Soils Bul. 33, pp. 71, figs. 11*).—"The purpose of this bulletin is to bring together and arrange in a logical sequence the results of the numerous investigations which have been made on the relation of calcium sulphate to aqueous solutions. Experimental methods and details are either omitted or, if of unusual interest, are described but briefly, since the numerous references to the literature which

are given will make them available to anyone who may be interested. In like manner practical applications of the results are merely indicated, as their discussion can be more profitably given elsewhere than in this necessarily technical description of a chemical problem."

The bulletin deals with the transformations of the different modifications of calcium sulphate; the occurrence of calcium sulphate in nature; solubility of the salt in water and in aqueous solutions of calcium sulphate and other calcium salts, of electrolytes not containing a common ion, and of nonelectrolytes, and calcium sulphate in salt deposits in alkali regions. It is presented as "a chapter in the larger study of the chemistry of alkali," developing the theories advanced in Bulletin 17 of the Bureau (E. S. R., 13, p. 232) as far as calcium sulphate enters into the formation of alkali.

Of the forms in which calcium sulphate exists, namely, hemihydrate, dihydrate (gypsum), natural anhydrite, artificial anhydrite, gypsum and natural anhydrite occur together in nature and are the only forms which remain stable in any solution. The solubility of calcium sulphate in water apparently reaches a maximum at about 40° C., when about 2,100 parts per thousand go into solution. The presence of other substances in solution affects the solubility of gypsum, thus salts having a common ion depress the solubility, low concentration solutions of electrolytes which do not have a common ion increase the solubility, non-electrolytes differ in their effects. Solutions containing 48 parts per thousand of sulphuric acid behave like water. These results make it quite clear that the composition of the drainage water from alkali soils which contain a mixture of various salts can not be predicted from the relative solubilities of the salts present.

Reclamation of alkali soils, C. W. DORSEY (*U. S. Dept. Agr., Bur. Soils Bul. 34, pp. 30, pls. 4*).—This bulletin defines alkali; discusses its origin and accumulation in soils, its effect on crops, methods of preventing alkali accumulation, treatment of alkali soils, including cultivation of alkali resistant crops, use of chemical antidotes, and scraping, flushing, and flooding with and without drainage to free soils from alkali; and gives an account of the alkali reclamation experiments of the Bureau of Soils near Salt Lake City, Utah, Fresno, Cal., North Yakima, Wash., Tempe, Ariz., and Billings, Mont., and a summary of experience gained from these experiments, including possible injury to the land by constant flooding, resulting water-logging of the soil, destruction of tilth and loss of valuable fertilizing constituents, effect of hardpan in retarding leaching, clogging of drains by roots and silt, depth and distance apart for drains, and cost of reclaiming land by flooding and drainage.

As regards the last two points, it is stated that "in practice it is not advisable to place drains less than 3 ft. deep, and depths of 4 or 5 ft. or more give much better results.

"The distance apart at which drains should be placed depends largely on the character of the soil. In heavy soils rapid reclamation may be accomplished with drains 100 to 150 ft. apart. In porous sandy soils the distance may be greater, intervals of 250 to 300 ft. in many cases answering the purpose. The less the interval between drains the more rapid can reclamation be carried on, but the distances given above are conservative.

"As to the cost of carrying on such reclamation, it has been found to depend on the local conditions of each area. While in the central portion of the United States all sizes of drain tile are sold at reasonable prices, this is not the case in the West. . . . Even considering the exorbitant prices at which the farmer must purchase his tile, it is still possible in the greater number of western districts to provide an adequate drainage system for small tracts of land at an

average cost of from $15 to $25 an acre. . . . To reclaim lands containing any considerable amount of alkali will cost from $30 to $50 an acre, including the cost of installing drains, leveling the land, and constructing necessary levees and dikes, as well as the cost of flooding. The item of leveling has been estimated at from $5 to $15, which would cheapen the cost of reclamation just so much in case the land had previously been leveled."

Soil fertility, M. WHITNEY (*U. S. Dept. Agr., Farmers' Bul. 257, pp. 39, figs. 2*).—An address delivered before the Rich Neck Farmers' Club of Queen Anne Co., Maryland, "in which an endeavor was made to place in the hands of the practical farmer the results of recent investigations of this important problem couched in simple language and without a discussion of the technical scientific details upon which the conclusions rest."

The maintenance of soil fertility in grain farming, J. H. PETTIT (*Mo. Bd. Agr. Mo. Bul., 5 (1906), No. 8, pp. 24–38, pl. 1, figs. 4*).—The use of insoluble phosphates in connection with farm manure or green manuring with leguminous plants to supply an abundance of decaying organic matter in the soil, and thus render the insoluble phosphates more available, is advocated.

Our soil needs managing (*Agriculture [Nebr.], 5 (1906), No. 2, pp. 6–13*).—It is pointed out that the loss of fertility in Nebraska soils, which is becoming quite pronounced in many cases, is not due to lack of mineral elements of fertility, but to decline in humus and impairment of physical condition. Methods of cropping and tillage which will repair these deficiencies are discussed.

Example of how analysis of soil may be of use, A. MAYER (*Jour. Landw., 54 (1906), No. 1, pp. 47–50; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 522, II, p. 249*).—The determination of the potash requirements of 4 tobacco soils from Deli, Sumatra, by extraction with dilute hydrochloric acid is reported. Loss on ignition agreed approximately with humus only in case of sandy and sandy peat soils.

Clover sickness of the soil, P. KOSSOVICH (*Zhur. Opuitn. Agron. (Russ. Jour. Expt. Landw.), 6 (1905), No. 5, pp. 515–599*).—The author describes an extended series of experiments conducted during 6 years.

Numerous pot experiments were supplemented by a few field experiments. Clover sickness appeared in pot cultures as well as in the field. The soils used were chernozems and podzol clays. Parallel experiments were conducted with soils from clover-sick fields and from fields on which no clover had been raised. The results in general lead to the conclusion that clover sickness is directly connected with the impoverishment of the soil in nutritive substances, usually phosphoric acid, in the first place, and then in potash. The author finds no reason whatever for the assumption of the existence of a specific clover sickness due to the formation in the soil by the clover plant itself of compounds directly injurious to clover.—P. FIREMAN.

The loss of nitrogen from soils, H. SNYDER (*Minnesota Sta. Bul. 94, pp. 188–194*).—In connection with studies of the influence of different methods of farming upon the nitrogen content of soils which have been reported in previous bulletins of the station, samples of soil from typical farms in Minnesota were obtained and analyzed in 1895. Ten years later samples from the same fields were again analyzed, and the losses of nitrogen which had occurred during the period were determined.

The results, as briefly reported in this article, show that "the loss of nitrogen from 4 grain farms in 10 years amounted to from 3 to 5 times more than was removed by the crops. This loss was due to the rapid decay of the humus and the liberation of the nitrogen, which forms an essential part of the humus. The losses of nitrogen from these grain farms were practically the same as

from the experimental plats at the university farm. The results of the tests on the small plats are in accord with the field tests in different parts of the State.

"Where clover was grown, crops rotated, live stock kept, and farm manure used, an equilibrium as to the nitrogen content of the soil was maintained, the mineral plant food was kept in the most available condition and maximum yields were secured."

The nitrogen enrichment of soils through the growth of legumes, F. T. Shutt (*Canada Expt. Farms Rpts. 1905, pp. 127–130*).—The exhaustion of soil nitrogen by continuous cropping without manure is illustrated by analyses of virgin and cultivated soils of the Northwest Territories, and pot and plat experiments extending over two years are reported which show that when mammoth red clover was grown on soils and turned under there was a gain during the two years of 179 lbs. of nitrogen per acre to a depth of 9 in. in the pot experiments and 175 lbs. to a depth of 4 in. in the plat experiments.

Inoculation for the growth of legumes, F. T. Shutt (*Canada Expt. Farms Rpts. 1905, pp. 130–132, pl. 1*).—Pot and plat tests of pure cultures furnished by the Bureau of Plant Industry of this Department and the Ontario Agricultural College on clover and alfalfa are reported.

Comparisons were made of no treatment, inoculating seed, and inoculating soil in the pot experiments and of untreated and treated seed only in the plat experiments. In the pot experiments there was some increase, especially in case of soil inoculation, the Ontario Agricultural College culture being more efficient than the Bureau of Plant Industry cultures. In the plat experiments on clover inoculation of the seed increased the yield decidedly, the Washington culture being more effective than the Ontario culture. The results of the plat experiments with alfalfa were inconclusive.

The influence of charlock on nitrification in soils, E. Gutzeit (*Centbl. Bakt.* [*etc.*], *2. Abt., 16 (1906), No. 10–13, pp. 358–381; abs. in Jour. Chem. Soc.* [*London*], *90 (1906), No. 525, II, p. 476*).—Field experiments and bacteriological studies are reported which show that charlock may be prevented from producing seed by one sprinkling with a 15 per cent solution of iron sulphate, and that the injurious effect of the growth of such weeds on cultivated plants is due not only to their draft upon the plant food, moistures, etc., of the soil needed by the cultivated plant, but also to their influence upon the bacterial life of the soil, especially upon nitrification, which is checked by the draft of the weeds upon the lime and water content of the soil.

Bacteriological methods, using nutrient solutions inoculated with soils and also soil extracts as culture media, were found useful means of studying such questions.

On methods of bacteriological investigation of soils, Buhlert and Fickendey (*Centbl. Bakt.* [*etc.*], *2. Abt., 16 (1906), No. 10–13, pp. 399–405; abs. in Jour. Chem. Soc.* [*London*], *90 (1906), No. 525, II, p. 476*).—A modification of Remy's method of bacteriological examination of soils (inoculation of a definite culture medium with a fixed amount of soil shaken up in water) was used in the study of the influence of aeration on the decomposition of peptone, denitrification, nitrogen assimilation, and nitrification in sandy, loam, humus, calcareous, and garden soils. The results show that aeration reduced formation of ammonia from peptone, increased denitrification and nitrogen assimilation, and decreased nitrification except in case of the humus soil.

Green manures, F. B. Cruz (*Estac. Cent. Agron. Cuba Bul. 5, pp. 38, pls. 5*).—A compilation of information on this subject, adapted especially to Cuban conditions and confined largely to a discussion of the usefulness of cowpeas and velvet beans for this purpose.

The utilization of fertilizers under varying rainfalls, von Seelhorst (*Separate from Jahrb. Deut. Landw. Gesell., 21 (1906), pp. 61–72*).—The subject is discussed on the basis of laboratory and vegetation experiments, including those of the author and others. Emphasis is laid especially on the danger of loss of nitrogen in sandy soils, and it is claimed that leguminous cover crops play an important rôle not only as nitrogen collectors and humus formers, but as conservers of soil nitrogen and users of water, thus hindering the washing out of the soluble nitrogen of the soil.

Preservation of manure and its most profitable use, Immendorff and Förster (*Separate from Jahrb. Deut. Landw. Gesell., 21 (1906), pp. 49–61*).—Pfeiffer's conclusions regarding the preservation of manure (E. S. R., 14, p. 233) are given and the action of manure preserved in different ways on loam and sandy soils is discussed.

Sewage disposal in small gardens, A. F. T. Somerville (*Agr. Gaz. N. S. Wales, 17 (1906), No. 3, pp. 274–276*).—Simple methods of disposing of household sewage and wastes are briefly described.

Restoring the fertility of a run-down farm, C. E. Thorne (*Mo. Bd. Agr. Mo. Bul., 5 (1906), No. 8, pp. 3–24*).—In this paper the bringing up of a run-down soil by the "well-informed use of animal manures, reenforced with such fertilizing materials as may be required to more perfectly adapt these manures to the soils on which they are employed" is discussed.

On the influence of the reaction of the manure upon the yield, K. Aso and R. Bahadur (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 39–46, pl. 1*).—An account is given of pot experiments with peas, onions, barley, and rice "to compare the effects of the (neutral) disodium phosphate with the (acid) monosodium phosphate and with calcium superphosphate in presence of ammonium sulphate or of sodium nitrate in sand culture and in soil culture."

The conclusion was reached that "(1) the reaction of the manuring compounds is of very great influence; (2) the combination of ammonium sulphate and disodium phosphate yielded the best result in the case of paddy rice, while the mixture of sodium nitrate and monosodium phosphate produced the highest yield with barley and pea. . . . As a general conclusion, however, it may be mentioned that small changes in the reaction of the manure have often a much greater influence on the yield than might be presumed, and that the effects differ with different crops."

Naturally occurring fertilizers and waste products, F. T. Shutt (*Canada Expt. Farms Rpts. 1905, pp. 137–140*).—Analyses of marsh mud, semidecayed seaweed, gypsum or land plaster, cotton waste, and flue ashes are reported and discussed.

On the oxidation of nitrogen in the high-tension flame, J. Brode (*Ueber die Oxydation des Stickstoffes in der Hochspannungs-flamme. Halle: Wilhelm Knapp, 1905, pp. 63, figs. 19; rev. in Amer. Chem. Jour., 35 (1906), No. 4, p. 358*).—This monograph discusses the theory of the process and summarizes work done on the subject from the time of the first experiments of Bunsen and Kolbe, the researches of Muthman, Hofer, and Nernst, the author's experiments carried out during 1904–5 at the Technical High School of Carlsruhe being fully described. The latter dealt especially with the best means of producing the electric flame and with various factors affecting the oxidation efficiency.

The oxidation of atmospheric nitrogen with reference to the manufacture of nitrates and nitric acid, E. Renouf (*Amer. Chem. Jour., 35 (1906), No. 4, pp. 358–367, figs. 6*).—This is a review of this subject based upon an address by O. N. Witt, to which reference has already been made (E. S. R., 17, p. 746), and a monograph by J. Brode (see above).

The development of methods and the history of investigations on which they are based is traced, the principles and efficiency of some of the more successful methods are discussed, the essentials of a commercially successful method are enumerated, and the Birkeland and Eyde method, which it is claimed in large measure fulfills these conditions and is the most efficient yet proposed, is described. It has been shown that by this process, with cheap water power, nitric acid can be produced at a cost of less than 1.2 cts. per kilogram for energy or less than one-tenth of the present price of nitric acid. The most important factor affecting cost is the concentration of the dilute nitrous gases obtained. "This problem has not yet found its technical solution, doubtless it will be solved." Progress has been made in this direction by Birkeland and Eyde, resulting in the production of a basic calcium nitrate.

Other methods of utilizing the atmospheric nitrogen are briefly considered. Of the 4 methods thus far proposed 3 are chemical and 1 bacteriological. "The bacterial absorption of nitrogen is, at present, confined to leguminous plants, and unless a more active breed of bacteria can be developed, bacterial action, while valuable, can not replace the use of Chile saltpeter. The formation and decomposition of nitrids is the second method." Technical difficulties have thus far prevented the development of methods based upon this principle. "The third method is Frank's well-known process, in which pure nitrogen, not air, is absorbed by heated calcium carbid, forming calcium cyanamid, which is a valuable fertilizer. This process is on trial technically. Whether the calcium cyanamid can compete with the synthetic nitrate is doubtful. The fourth method is the nitrogen oxidation."

Nitrogenous fertilizer from the air (*Mark Lane Express, 94 (1906), Nos. 3881, Fert. and Feed., p. 111; 3884, Fert. and Feed. p. 11*).—Papers by Professor Silvanus Thompson, already noted (E. S. R., 17, p. 829), and by Sir William Ramsay in the Engineering Supplement of the London *Times*, are briefly reviewed with reference to the following features: (1) The necessity of a future new source of nitrogen for agriculture, (2) methods of production, and (3) fertilizing value of the products.

The general conclusion drawn from the review of these papers is "that agriculture will not languish from want of nitrogen when the nitrate of soda deposits have died a natural death from exhaustion; but that inexhaustible supplies will be available, and probably at lower prices."

The electric production of nitrates from the atmosphere (*Nature [London], 73 (1906), No. 1893, pp. 355, 356*).—This is an abstract of an address by S. P. Thompson, which has already been referred to (E. S. R., 17, p. 829), discussing especially the success of the Birkeland and Eyde process in Norway.

It is stated that in the experimental factories using this process 500 kg. of nitric acid per year have been produced for every kilowatt of power. "The conditions in Norway were exceptionally good for the furnishing of power at exceedingly low rates. Hence the new product could compete with Chile saltpeter on the market, and would become every year more valuable as the demand for nitrates increased and the natural supplies became exhausted."

New fertilizers prepared from atmospheric nitrogen, C. Dusserre (*Chron. Agr. Vaud, 19 (1906), No. 5, pp. 123–127*).—Experiments with lime nitrogen on potatoes are reported, and the probable value of calcium nitrate prepared by electrical methods is discussed.

Water power in Norway and the future of the Birkeland and Eyde discovery, L. Grandeau (*Jour. Agr. Prat., n. ser., 11 (1906), No. 12, pp. 361, 362, fig. 1*).—Statistics are given of the horsepower of various waterfalls (aggre-

gating about 300,000 horsepower) which have been acquired in Norway for the purpose of the manufacture of nitric acid from the air.

On the manurial value of calcium cyanamid, K. Aso (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 47–52*).—Experiments in open-bottom cylinders sunk in the ground and in pots to compare calcium cyanamid with ammonium sulphate and sodium nitrate on upland and paddy rice and hemp grown on sandy and loamy soils are reported.

All the results show distinctly that calcium cyanamid is an effective nitrogenous fertilizer, the only unsatisfactory result being that with paddy soil. That soil was rich in humus and closely related to moor soils which, according to Tacke and Feilitzen, do not yield such satisfactory results with calcium cyanamid as other soils do. In general the calcium cyanamid was not inferior to ammonium sulphate and Chile saltpeter.

The efficacy of calcium cyanamid under different conditions, R. Inamura (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 53–55*).—Pot experiments with *Brassica chinensis* are briefly reported to show that calcium cyanamid was more effective in combination with superphosphate than with neutral phosphate, the acid phosphate neutralizing the ammonium carbonate produced in the soil from the calcium cyanamid and thus bringing about the conditions most favorable to the growth of the Brassica. The combination referred to was much more effective than ammonium sulphate with superphosphate without addition of lime.

Artificial nitrates and the preservation of soil industry (*Agr. Students' Gaz., n. ser., 12 (1906), No. 6, pp. 195–198*).—This article is an argument in favor of a system of cropping which keeps the soil well covered and stocked with organic matter and against "excessive cultivation of grain with the aid of artificial nitrogenous manures," the view being that the former increases the natural capacity of soils to fix nitrogen and the latter tends to destroy this power.

The oxidation of ammonia to nitrogen-oxid compounds, O. Schmidt and R. Böcker (*Ber. Deut. Chem. Gesell., 39 (1906), No. 6, pp. 1366–1370; abs. in Amer. Jour. Sci., 4. ser., 22 (1906), No. 127, pp. 78, 79*).—The two principal methods of oxidizing ammonia, viz, combustion in electric flames, and oxidation by means of contact substances (platinum and platinized asbestos), are referred to, and a series of tests of the efficiency of combustion in tubes filled with platinized asbestos are reported. The total oxidation secured varied from 70.3 to 80.45 per cent, with an average of 75 to 76 per cent, apparently depending mainly upon the temperature. Red heat appeared to be the most favorable temperature for oxidation. The process of producing nitrates is not considered profitable.

A rational process for obtaining ammonia and sal-ammoniac by the utilization of residuary and waste products (*Sci. Amer. Sup., 61 (1906), No. 1580, pp. 25314, 25315*).—Various processes for obtaining these substances from guano, gas liquor, bones, wool, leather, horn, feather, and similar wastes are briefly described. The formulas for preparing artificial fertilizers from lye waste are also given. The information given in the article is taken from Koller's handbook on the utilization of waste products (E. S. R., 14, p. 717).

On the application of Chile saltpeter as top-dressing for some Japanese crops, K. Aso (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 75, 76*).—In plat experiments with upland rice and Colocasia there was an increase from top-dressing with sodium nitrate; with sesame there was no increase.

The manurial value of different potassium compounds for barley and rice, K. Aso (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 67–72*).—From

pot experiments with different potash salts on barley and rice the following conclusions are drawn:

(1) While the chlorid hastened the flowering process and increased grain production, the increase being highest in the case of barley, it reduced to a like extent the yield of the rice; (2) the fertilizing value of the silicate was highest in several cases, and this material may be considered a favorable potash fertilizer for the Gramineæ; (3) while the chlorid acted very favorably in the production of grain, the sulphate was more favorable to the production of straw, in accord with Sebelien's former observations; (4) carbonate was inferior to sulphate in all cases when it was applied with secondary sodium phosphate, a physiologically alkaline manure.

On the effect of various potassic manures on the growth of Colocasia antiquorum, S. Namikawa (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 73, 74*).—In plat experiments it was observed that kainit and 40 per cent potash salt were about equally effective, considerably more so than wood ashes.

On the fertilizing value of steamed Thomas slag, O. Böttcher (*Deut. Landw. Presse, 33 (1906), No. 27, pp. 231, 232*).—Comparative pot and field tests of superphosphate and Thomas slag which had been disintegrated by subjecting it to steam under pressure and ground in the usual way are reported. The pot experiments were made with oats, the field experiments with a mixture of oats, barley, peas, and vetch and on meadow grasses. The results indicate in general that the steamed slag is slightly less effective than the ground.

On the factors which influence the fertilizing action of difficultly soluble phosphates, D. N. Prianishnikov (*Abs. in Chem. Ztg., 30 (1906), No. 37, p. 438*).—This is an abstract of a paper presented at the Sixth International Congress of Applied Chemistry at Rome, 1906. The paper discusses this subject from 4 standpoints, (1) the properties of the phosphates themselves, (2) the individuality of the plants on which they are used, (3) the properties of the soil, and (4) the character of the associated fertilizers. Particular attention is given to the fourth point, which has been discussed in previous articles by the author (E. S. R., 17, p. 538).

Thomas-ammonium-phosphate lime, a new mineral fertilizer, E. Haselhoff (*Fühling's Landw. Ztg., 55 (1906), No. 8, pp. 257–264*).—This material (see also E. S. R., 17, p. 649) is shown to rapidly undergo decomposition with loss of nitrogen.

Thomas-ammonium-phosphate lime, Kettler (*Deut. Zuckerindus., 31 (1906), p. 390; abs. in Chem. Ztg., 30 (1906), No. 24, Repert. No. 7, p. 95*).—This material, which is described as an intimate mixture of Thomas slag, ammonium sulphate, and lime residue from sugar factories is highly recommended.

A contribution to the bibliography of the use of sulphate of iron in agriculture, H. E. Horton (*Chicago, Ill., 1906, pp. 69*).—This is a biliography of 452 references, beginning with the work of Thaer in Germany in 1809 and continuing to 1905.

The limestone and lime industry of West Virginia, G. P. Grimsley (*W. Va. Geol. Survey [Pub.], 3 (1905), pp. 312–422, pls. 11, figs. 6*).—This report contains chapters on distribution and properties of lime in minerals and rocks, the limestones of West Virginia, technology of lime manufacture, and the uses of limestone and lime.

Commercial fertilizers, J. L. Hills and C. H. Jones (*Vermont Sta. Bul. 123, pp. 137–204*).—This bulletin reports the results of analyses of 130 brands of fertilizers, the output of 12 companies, collected during the spring of 1906, compares the results obtained with those of 4 previous years, and discusses selling price, valuation, and purchase of fertilizers, and the moisture relations of soils.

It was found that 85 per cent of the brands met their guaranties and that the crude stock used in the fertilizers was generally of good quality. The average selling price was $29.52, the average valuation $19.38. "A comparison of analyses of brands for 5 years shows in some cases essential evenness and in others considerable variation in composition." The advantages and disadvantages of buying mixed goods and separate ingredients are briefly stated and the cooperative purchase of unmixed fertilizing materials is recommended as more economical.

A general discussion of weather conditions and chemical composition, physical characteristics, biological content, irrigation, drainage, and tillage of soils with reference to control of moisture and better utilization of fertilizers are included in the bulletin.

AGRICULTURAL BOTANY.

The function of silica in the nutrition of cereals, I, A. D. Hall and C. G. T. Morison (*Proc. Roy. Soc.* [*London*], *Ser. B., 77* (*1906*), *No. B 520, pp. 455–477, figs. 11*).—A brief summary is presented of opinions relative to the function of silica in plants.

The authors call attention to the constant and considerable proportion of silica in the ash of certain plants and give an account of field and pot experiments to determine if possible its action. As a result of their investigations they consider that silica, while not an essential constituent of plant food, plays an important part in the nutrition of cereal plants, like barley. The effect of a free supply of soluble silica shows itself in an increased and earlier formation of grain, and it acts by causing an increased assimilation of phosphoric acid by the plant.

There appears to be no evidence that the silica within the plant causes a more thorough assimilation of the phosphoric acid, or that in itself it promotes the transfer of food materials from one part of the plant to the other. The physiological function of silica are found to take place within the plant tissues, and not in the soil as has sometimes been claimed.

Utilization of the nitrogen of the air by plants, T. Jamieson (*Agr. Research Assoc.* [*Scot.*] *Rpt. 1905, pp. 81, pls. 12*).—The author rejects the theory of Hellriegel and others that nitrogen assimilation in the higher plants is confined to the Leguminosæ and a few other orders of plants, where the fixation takes place through the symbiotic action of micro-organisms in the root tubercles.

He claims that nitrogen assimilation is a function common to many plants, through the presence of specialized cells in the epidermis and also specialized hairs on various aerial parts of the plant most abundant in the younger parts of the plant. The basis of this theory seems to be albumin reactions observed in certain thin-walled cells of the epidermis of the leaves and in certain hairs, the author arguing that the formation of the albumin took place where observed, and the absence of the reaction with iodin indicated the transfer of the nitrogenous compounds from the specialized organs to the leaves for the use of the plant.

The action of radium on plants (*Jardin, 20* (*1906*), *No. 457, p. 65*).—The influence of radium on seeds, it is stated, depends upon the thickness of the seed envelop, its distance away from the radium, and the quantity of moist soil covering it. When the moisture is excessive, germination may be retarded or completely arrested. The transformations which take place in the cellular tissues are the same as those occasioned by too much light. Experiments made with other radioactive substances, such as radiotellurium, have given similar

results, while with polonium no definite action has been obtained. If the air is charged with emanations of radium, vegetation is retarded or entirely destroyed.

The presence of hydrocyanic acid in seeds and plants (*Prog. Agr. et Vit. (Ed. l'Est), 27 (1906), No. 25, pp. 736–741*).—A compilation is given showing the presence of hydrocyanic acid in plants, and its wide distribution is indicated by the various plants which are reported to have been determined as containing it. Among the plants reported as containing this substance are a number of species of Phaseolus, lupines, vetches, lotus, sorghum, flax, cassava, cherry laurel, currants, etc. A brief list of publications relating to this topic is given.

Hydrocyanic acid in Sambucus nigra, L. GUIGNARD (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), Nos. 1, pp. 16–20; 26, pp. 1193–1201*); and E. BOURQUELOT and E. DANJOU (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), Nos. 1, pp. 59–61; 15, pp. 598–600*).—Although working independently, the authors simultaneously announce finding in the fresh green leaves of the common European elderberry a glucosid, which under the action of an enzym yields hydrocyanic acid, as much as 126 mg. of the acid being obtained from 1 kg. of fresh leaves.

In the second paper by Bourquelot and Danjou the name sambunigrin is given the glucosid, and some of its properties are described. In subsequent investigations of Guignard the glucosid was found in the cortex, younger shoots, leaves, and immature fruits, the amounts varying appreciably with the stages of growth and disappearing entirely from the fruits when ripe.

In addition to occurring in *S. nigra*, this glucosid was found in the related species, *S. racemosa* and *S. ebulus*. It is said that the presence of the glucosid is associated with chlorophyll activity, but it is not to be considered a reserve material. It is most abundant in the leaves, from which it is not transferred toward the end of the growing season, but remains in the fallen leaves.

On the presence of hydrocyanic acid in certain species of currants, L. GUIGNARD (*Comp Rend. Acad. Sci. [Paris], 141 (1905), No. 10, pp. 448–452*).—Following his investigations on the presence of hydrocyanic acid in the European elderberry noted above, the author has examined the roots, stems, leaves, and fruits of a number of other plants, and reports in the leaves of the common red currant the presence of a glucosid which yields hydrocyanic acid.

The amount was found to vary with the stage of growth, being most abundant in April and falling off with the ripening of the fruit, and at the end of August the amount was found to be less than one-half that observed earlier in the season. Several related species were also investigated. The tests failed to show the presence of the glucosid in a number of instances, but it was observed in *Ribes nigrum*, *R. aureum*, and *R. uva-crispa*.

The development of amylase during germination, J. EFFRONT (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 16, pp. 626–628*).—In making a study of the amylase occurring in germinating seed, the author investigated its liquefying and saccharifying power. The saccharifying power increases irregularly with the duration of germination, attaining a maximum, after which it gradually diminishes. The liquefying power is attained more gradually but regularly and, arriving at a maximum, maintains this for a considerable time.

In the course of his investigations the author found that in the germination of malt at a temperature of 15° C. the maximum diastatic action is attained in 10 or 11 days. The amylase which is developed during the course of germination remains in the seed, its migration to the roots and leaves being very insignificant.

The effect of a number of chemicals on germination was also studied. Phosphates, lime water, and a very dilute solution of copper sulphate appeared to

favor germination. Xylol (1 cc. per liter) favors both the germinating power of the seed and the saccharifying power of the enzym. Ammonium chlorid increases the liquefying power of the enzym, and lactic acid, vegetable peptone, and calcium hypochlorite favor germination and also diastatic action.

The osmotic strength of cell sap in plants growing under different conditions, E. Drabble and Hilda Lake (*New Phytol., 4 (1905), No. 8, pp. 189–191*).—It is claimed that comparatively few observations on the osmotic strength of cell sap in plants growing under different physical conditions have been made, and the authors have undertaken a series of experiments to determine this factor.

The method devised involves the observation of the plasmolysis of the cells, and by this means a number of plants were examined with regard to the strength of their cell sap. A series of sodium-chlorid solutions was made up in various gram-molecule concentrations. Portions of the plant the strength of whose cell sap was to be determined were placed in water. Strips of the epidermis of the leaf were placed in a drop of the solution and gently covered with a cover glass, and when the solution just failed to plasmolyse it was taken as isotonic with the cell sap. It was found most convenient to use plants with red coloring matter in the epidermis, and but little difference was noticed in the strength of sap between the cells containing the red and those containing the colorless materials in the same leaf.

The data presented show that there was a greater concentration of cell sap in those plants which had been most strongly subjected to factors tending to promote a loss of water by transpiration. In considering the effect of the concentration of the cell sap on the absorption of water, it is shown that the concentration exerts an important physiological bearing on the plants. From observations made on plants growing in mountain regions and other dry situations it is determined that a high osmotic strength of cell sap may prove a valuable physiological character in connection with water absorption.

On the sensibility of chlorophyll in tolerant and intolerant species of plants, W. Lubimenko (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 13, pp. 535, 536*).—In continuation of previous observations (E. S. R., 17, p. 651), the author made comparative studies of the carbon-dioxid assimilation of plants tolerant and intolerant to light.

For the intolerant species he selected Scotch pine, European larch, white birch, and the common locust, while for the shade-growing species fir, yew, linden, and beech were chosen. For each of these species 2 series of experiments were carried on, one in artificial feeble light, the other in full sunlight. Spectroscopic studies were made of the chlorophyll solutions of the different species.

It is claimed that the assimilative energy depends on the concentration of the coloring matter in the chloroplast. The curve which represents the assimilative energy following the concentration of the coloring matter reaches its highest limit under natural radiation for the intolerant species and falls below that limit with the tolerant ones. The author raises the question as to whether among tolerant and intolerant plants the physical difference in concentration of chlorophyll is not possibly due to difference in physiological irritability of protoplasm when exposed to light.

The growth of chlorophyll-bearing plants in confined atmospheres in the presence of organic materials, Molliard (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 7, pp. 389–391*).—A report is given of investigations with radishes grown in fermentation tubes in the presence of various forms of starch, sugar, etc., which show that the plants were able to make considerable growth.

utilizing the carbohydrates through their roots. In the absence of light the utilization of sugars took place very slowly, and it appears that for this form of synthesis sunlight is necessary.

Handbook of flower pollination, P. Knuth, trans. by J. R. A. Davis (*Oxford: The Clarendon Press, 1906, pp. XIX+382, figs. 81*).—This volume, which is No. 1 of a series, is based on Müller's work on The Fertilization of Flowers by Insects, and it deals with the structure of flowers and the relation of insects to pollination. A bibliography of more than 3,800 titles completes the volume.

Color stimulus and vital functions of plants, J. B. Dandeno (*Rpt. Mich. Acad. Sci., 7 (1905), pp. 44–47*).—A number of experiments are reported upon which were carried on to determine the effects of different portions of the solar spectrum on different functions of plants. Red, yellow, green, blue, and violet colored glass plates were used, which gave results approximating those obtained with pure colors. The detailed results are given, which show that red stimulates growth more than yellow, while yellow is more active in photosynthesis. Blue and violet exercise greater formative influences than the other colors.

A study of the effect of dilute solutions of hydrochloric acid upon the radicles of corn seedlings, F. A. Loew (*Rpt. Mich. Acad. Sci., 7 (1905), pp. 50–52*).—The author carried on a series of experiments to ascertain the cause of the death of the radicles of germinating grains of corn in extremely dilute solutions of hydrochloric acid. Different lots were subjected to treatment with a 1/256 normal solution of hydrochloric acid and comparisons made with seedlings germinated under normal conditions.

It was found that the amount of acid in dilute solutions of hydrochloric acid is reduced by growing corn seedlings in them. The mineral content of radicles killed in 1/256 normal hydrochloric acid was nearly one-half that of normal radicles. Bacteria and fungi were found to thrive in the solution in which the seedlings had been killed. Seedlings which were killed in the hydrochloric acid solution mentioned above excreted much material rich in potash, and it was found that those grown in distilled water excreted potash, or some other alkali.

The death of the radicles is believed to be caused by a chemical action, from the fact that the amount of acid in solutions in which the seedlings were grown became greatly reduced. The fact that the killed radicles contained less potassium than normal ones and that the solution in which they were killed was rich in potassium, suggests that death is caused by a chemical action between the acid of the solution and the potassium of the radicle. The fact that fungi and bacteria grew vigorously in the solution in which the seedlings were killed, but did not thrive in the distilled water in which the seedlings were growing, suggests that the excretions caused by the acid solution might be some organic compound especially nutritious to these lower forms of plant life.

The toxic action of copper sulphate upon certain algæ in the presence of foreign substances, Ellen B. Bach (*Rpt. Mich. Acad. Sci., 7 (1905), pp. 48–50*).—A toxic action of copper sulphate of extreme dilution upon certain algæ having been claimed, the author carried on a series of experiments to test the strength required to kill some of the lower algæ in aquarium jars without being injurious to the higher forms.

The presence of foreign substances in the water was found to exercise a very appreciable influence on the strength of solution required, and it appears that the strength of the copper sulphate necessary to free an aquarium from algæ must depend upon the percentage of plant life present, the amount of nonchemical foreign substance in the water, and the kind of water. It seems possible

from the results obtained that if copper sulphate were introduced at the surface of a body of water of considerable depth, the plants at the surface would be killed and absorb sufficient of the copper to render the solution too dilute to be toxic at a greater depth.

International catalogue of scientific literature. R—Bacteriology (*Internat. Cat. Sci. Lit., 4. (1906), pp. VIII + 500*).—This catalogue is in continuation of previous issues on the same subject, the arrangement being identical with that hitherto described (E. S. R., 14, p. 1049). The present volume is intended to cover the bacteriological literature of 1904 and embraces author and subject catalogues, over 3,600 titles being given. There are many references to articles included that can hardly be called bacteriological, and the American literature is still inadequately represented.

FIELD CROPS.

Field experiments with farm crops, W. SAUNDERS, J. H. GRISDALE, W. T. MACOUN, F. T. SHUTT, J. FLETCHER, R. ROBERTSON, S. A. BEDFORD, A. MACKAY, and T. A. SHARPE (*Canada Expt. Farms Rpts. 1905, pp. 5–45, 75–90, 116–121, 123, 124, 144–148, 201–232, 265–286, 321–341, 357–361, 364–380, 401–415, pls. 6*).—The report on work with field crops at the Canada experimental farms in 1905. Most of the lines of investigation have been previously described (E. S. R., 17, p. 125.)

Wheat.—The results of the uniform test plats show that among 59 varieties of spring wheat Australia F, although badly rusted, ranked first with a yield of 39 bu. 40 lbs. per acre. Hungarian White and Kirsche, varieties added to the test plat this season, are described. The list contains 17 varieties produced at the Central Experimental Farm. Preston, Herisson Bearded, Advance, Pringle Champlain, Huron, and Red Fern were the most productive varieties, as shown by the yields for the last 5 years. These are all bearded varieties, and Pringle Champlain and Red Fern give promise of good milling qualities. Red Fife, White Fife, White Russian, and Laurel were among the most productive beardless sorts, and of these Red Fife and White Fife are the best for making strong flour. Aurora was the earliest variety of spring wheat grown at the Central Experimental Farm this season, while Early Riga, Ebert, Riga, Downy Riga, and Gehun were the earliest in the regular plats.

Of 11 varieties of durum wheat Roumanian, which stood at the head of the list this year with a yield of 40 bu. 20 lbs. per acre, has also given the best yield during the last 5 years. The 18 varieties of winter wheat under test ranged in yield from 30 to 50 bu. per acre, the leading varieties being American Banner, Gold Coin, and Jones Winter Fife, yielding 50 bu., 49 bu., and 45 bu. 20 lbs. per acre, respectively.

At the Nova Scotia farm at Nappan, Pringle Champlain stood first with a yield of 35 bu. among 28 varieties, and Herisson Bearded last with a yield of 13 bu. 20 lbs. Roumanian durum wheat yielded 22 bu. per acre, while Goose, Yellow Gharnovka, and Mahmoudi yielded 17 bu. 20 lbs., 16 bu. 40 lbs., and 14 bu., respectively.

At the Manitoba farm the yields of 30 varieties ranged from 33 bu. 20 lbs. to 52 bu. per acre. The varieties yielding 45 bu. or more per acre were, in decreasing order of yield, as follows: Preston, Laurel, White Fife, Huron, Advance, Red Fife, and Wellman Fife. The yields of 4 durum wheats under test were as follows: Yellow Gharnovka 54 bu., Roumanian 50 bu., Goose 49 bu., and Mahmoudi 46 bu. 40 lbs. per acre. Mahmoudi suffered slightly from rust while the other varieties were free from it. A mixture of 200 lbs. of superphosphate,

100 lbs. of nitrate of soda, and 100 lbs. of muriate of potash per acre, one-half applied before sowing and one-half when the wheat was 2 or 3 in. high gave better results than any other applications used. The soil used for the experiment was a light loam, cropped for many years without fertilizers of any kind.

Wheat grown after peas gave better results than where grown after roots, wheat, corn, or flax. The yields in this same test were also in favor of the use of the shoe drill as compared with the disk drill, and of sowing 1½ in. deep as compared with 3 in. deep. Five varieties of wheat grown in fields varying from 5 to 11 acres in size ranged in yield from 36 bu. 20 lbs. to 48 bu. 12 lbs. A 10-acre field of Preston stood at the head of the list and a 6-acre field of the same variety at the foot. Selected and unselected seed of different varieties were compared at this farm and in each case the yields were in favor of the selected seed.

At Indian Head, where 34 varieties of spring wheat were grown, the yields varied from 16 bu. 40 lbs. to 46 bu. per acre, the leading varieties being Minnesota No. 163, Huron, Haynes Blue Stem, White Fife, McKendry Fife, Bishop, and Wellman Fife, all yielding about 43 bu. per acre. Of 10 varieties grown in field lots a 5-acre field of Huron ranked first with a yield of 47 bu. 12 lbs., and a 10-acre field of Preston gave a yield of 46 bu. 54 lbs. per acre. The average per acre for all varieties in this test was 40 bu. 3 lbs. In a fertilizer test 200 lbs. of muriate of potash per acre, sown before the grain and harrowed in, gave the best results. The 4 varieties of durum wheats grown produced the following yields: Goose 54 bu. 40 lbs., Yellow Gharnovka 52 bu., Mahmoudi 51 bu. 20 lbs., Roumanian 45 bu. 40 lbs. per acre.

At Agassiz, B. C., an attack of the midge nearly destroyed the wheat crop and the 28 varieties of spring wheat gave yields ranging from only 5 bu. 20 lbs. to 16 bu. per acre, and the yields of 4 varieties of durum wheats from 8 to 12 bu. per acre. Abundance ranked first with a yield of 33 bu. 20 lbs. per acre among 6 varieties of winter wheat. Choice Club was badly winterkilled.

Spelt and emmer.—At the Central Experimental Farm 10 varieties of spelt and emmer ranged in yield from 1,380 to 2,400 lbs. of grain per acre. Most varieties rusted but slightly. White spelt and Thick emmer are reported as considerably rusted. Long emmer and Single emmer are to be rejected on account of their extreme lateness in ripening. At Nappan Red spelt and Common emmer gave about equal yields of grain, but Red spelt produced 50 per cent more straw than Common emmer. The yields of these crops at the other farms are reported without comment.

Oats.—At the Central Experimental Farm 67 varieties of oats were grown this season, including 7 varieties originated at the farm. Banner, White Giant, and Überfluss, yielding 84 bu. 4 lbs., 84 bu. 4 lbs., and 80 bu., respectively, stood at the head of the list. Banner, White Giant, Lincoln, and Virginia White Abundance have been most satisfactory during the past 5 years among the white varieties; Überflus and Holstein Prolific among the mixed sorts; Mennonite and Columbus among the pure yellow oats, and Black Beauty among the black varieties.

At Nappan 39 varieties of oats were under trial. The yields ranged from 45 bu. 30 lbs. to 92 bu. 32 lbs. per acre. Improved Ligowo and Mennonite ranked first with yields of over 90 bu.

Of 41 varieties of oats grown at Brandon, Golden Giant, Improved American, and Goldfinder were the most productive sorts. The yields of all the varieties at this farm ranged from 82 bu. 12 lbs. to 135 bu. 10 lbs. per acre. At this farm oats on summer fallow yielded 115 bu. 30 lbs.; after corn, 106 bu. 16 lbs.; and after roots, 71 bu. 0.06 lb. per acre.

At Indian Head the yields of 41 varieties of oats varied from 73 bu. 18 lbs. to 117 bu. 22 lbs. The leading 10 varieties, given in decreasing order of yield, produced 110 bu. or more per acre: Goldfinder, Pioneer, Siberian, Joanette, Golden Tartarian, Twentieth Century, Columbus, Golden Beauty, American Triumph, and Tartar King. In field lots from $2\frac{3}{4}$ to 10 acres in size Banner, among 12 different varieties on a 10-acre field, ranked first with a yield of 107 bu. 13 lbs. per acre. The average yield per acre of these varieties was 93 bu. 30 lbs. Banner also stands first at this farm in a comparison of 9 varieties for 5 years.

At the British Columbia farm Abundance, Golden Fleece, and Siberian gave the best results. These varieties were also least affected with rust.

Barley.—In 1905 among the 6-rowed varieties of barley Nugent, a variety produced at the Central Experimental Farm, gave the best yield at that institution. The yields this year ranged from 40 bu. to 72 bu. 24 lbs. per acre. Twenty-nine varieties, including 12 produced at the farm, were grown. The most productive sorts for the last 5 years were Stella, Odessa, Nugent, Mensury, and Blue Long Head, and among the earliest are Odessa and Mensury. Of 25 varieties of 2-rowed barley, including 8 produced at the farm, Swan Neck, Danish Chevalier, and French Chevalier led in yield.

The average returns for the last 5 years at this farm show that French Chevalier, Danish Chevalier, and Canadian Thorpe were most productive. Standwell, Beaver, and Princess Svalöf also gave good results, but the last mentioned is late in ripening. Beaver, the earliest 2-rowed variety as shown by 5-year tests, ripens about 2 or 3 days before French Chevalier. Beardless and hulless varieties of 2-rowed barley have been found deficient in strength of straw.

At the experimental farm in Manitoba 19 6-rowed and 15 2-rowed varieties of barley were compared. Of the 6-rowed varieties Mensury produced the stiffest straw, and Mansfield, a crossbred variety produced at the Central Experimental Farm, led in yield with 77 bu. 24 lbs. per acre. This variety also gave the highest average yield for the past 6 years. Gordon, the leading 2-rowed variety, produced 67 bu. 44 lbs. per acre, followed by Jarvis, Harvey, French Chevalier, and Danish Chevalier, all producing over 60 bu. Barley after roots gave a better yield than after corn or on summer fallow.

At Indian Head the leading varieties of 2-rowed barley were Beaver, Invincible, Gordon, and Standwell, and the leading 6-rowed sorts, Stella, Nugent, Claude, Blue Long Head, and Yale. In field lots of several acres each Odessa, Claude, and Mansfield yielded 73 bu. 34 lbs., 72 bu. 22 lbs., and 70 bu. 45 lbs. per acre, respectively. The average yield per acre for 10 varieties so grown was 63 bu. 17 lbs. Nine varieties grown in field lots for 5 years ranged in growing period from 99 to 110 days, and in yield from 50 bu. to 64 bu. 46 lbs. per acre.

Rye.—At the Central Experimental Farm at Ottawa spring rye produced 40 bu. per acre, and 4 varieties of winter rye ranged in yield from 28 bu. 12 lbs. to 36 bu. 4 lbs., the leading variety being Mammoth White.

At Indian Head 53 bu. 32 lbs. per acre was secured from spring rye and 40 bu. from winter rye. The following yields of winter rye sown on October 15 were secured at the experimental farm for British Columbia: Thousand Fold 47 bu. 48 lbs., Mammoth White 46 bu. 24 lbs., Giant 44 bu. 16 lbs., and Emerald 42 bu. 8 lbs. per acre.

Corn.—This season Eureka, Pride of the North, and Thorobred White Flint were the leading varieties of corn at Ottawa. The average yield from drills was 30 tons 987 lbs., and from hills, 28 tons 1,221 lbs. per acre. Thorobred White Flint, Eureka, and Red Cob Ensilage gave the best results at the experimental farm for the Maritime Provinces; Longfellow, Angel of Midnight, and Compton Early at the experimental farm for Manitoba; Eureka, Superior Fodder, and

Pride of the North at the experimental farm for the Northwest Territories, and Pride of the North, Thorobred White Flint, and White Cap Yellow Dent at the farm for British Columbia. Distance experiments with varying results are also reported.

Peas.—Among the most productive varieties grown for the past 5 years at the Central Experimental Farm are Golden Vine, Victoria, Mackay, White Wonder, Prince, Canadian Beauty, and Prussian Blue. Chancellor, perhaps the earliest variety at the farm, ripens about 4 days before Golden Vine. Fifteen of the 29 varieties tested this season were produced at the farm. Mummy, the leading variety at Nappan, yielded 39 bu. 20 lbs.; Early Britain ranked first at Brandon with 51 bu. 40 lbs.; Kent at Indian Head, yielding 70 bu., and Paragon at Agassiz with 50 bu. per acre.

Potatoes.—Of 47 medium and late varieties of potatoes grown at Ottawa, Dalmeny Beauty, Rural Blush, Ashleaf Kidney, Manistee, Norcross, Carman No. 1, and Sabean Elephant, given in the decreasing order of yield, produced over 400 bu. per acre, Dalmeny Beauty giving a yield of 475 bu. 12 lbs. and Sabean Elephant of 404 bu. 48 lbs. Of 32 early varieties Maule Thorobred gave the best yield. The 12 best-yielding varieties during the past 5 years have given average yields ranging from 418 bu. to 456 bu. 43 lbs. per acre. The 3 leading varieties were Dr. Maercker, Late Puritan, and Carman No. 1. In a test of resistance to blight Holborn Abundance ranked first and was also one of the most productive sorts grown. The average increase in yield per acre of marketable potatoes, apparently due to spraying with Bordeaux mixture, was 92 bu. 31 lbs. Of different solutions used in spraying Bordeaux mixture and Paris green were most effective.

At Brandon the yields of 49 varieties of potatoes ranged from 291 bu. to 887 bu. 20 lbs. per acre. Dreer Standard headed the list in productiveness. The 12 varieties standing next varied in yield per acre from 700 bu. to 799 bu. 20 lbs.

At Indian Head, Seedling No. 7 and Vermont Gold Coin headed the list with yields per acre of 640 bu. 48 lbs. and 625 bu. 24 lbs., respectively. At Agassiz Late Puritan and Empire State stood first in yield among 44 varieties.

Flax.—Of 7 varieties grown at Ottawa, Riga, Russian, and Novarossick yielded 10 bu. 40 lbs., 9 bu. 30 lbs., and 9 bu. 10 lbs. per acre, respectively. At Brandon much better yields were produced this season and the leading varieties, Russian and Improved Russian, gave yields of 30 bu. 40 lbs. and 30 bu., respectively. Sowing at the rate of 50 lbs. of seed per acre again gave the best yields at Indian Head. The leading variety at this farm was Yellow Seeded.

Buckwheat.—Five varieties of buckwheat were sown June 20 at Nappan and harvested September 1. Siberian, or Tartarian, ranked first in yield with 43 bu. 16 lbs. per acre, Rye buckwheat, with 37 bu. 24 lbs., standing next.

Root crops.—At Ottawa, turnips, mangels, carrots, and sugar beets were sown on May 10 and May 23, and in each case the first sowing gave much the better yields. The leading varieties and their yields per acre were as follows: Perfection Swede turnip 36 tons 500 lbs., Half Long Sugar White mangel 52 tons 600 lbs., Mammoth White Intermediate carrot 32 tons 500 lbs., and Danish Red Top sugar beet 40 tons 1,300 lbs. These yields represent the first sowing.

At Nappan the first sowing of root crops was made about May 25 and the second about June 8. The results were also much in favor of the early sowing. The leading varieties were Magnum Bonum turnip, Mammoth Yellow Intermediate mangel, Red Top sugar beet, and Improved Short White carrot. The use of commercial fertilizers in addition to an application of 20 tons of barnyard manure per acre did not prove profitable for these crops. The work and results with roots at Brandon, Indian Head, and Agassiz were similar to the results just given.

Tobacco.—Forty-nine varieties of tobacco were grown at Ottawa this season and of 7 varieties having done well in previous years and grown in larger areas, Connecticut Seed Leaf and Kentucky Burley gave the largest total yields per acre of all grades of leaf. Little Oronoka and Lacks were ripe on September 15 and the other varieties were nearly ripe.

Grasses and other forage crops.—Inoculated and uninoculated seed of clover and alfalfa gave the same results with reference to nodules on the roots at Nappan, but the clover in each case had many more nodules than were found on the alfalfa. Green soy beans produced a much larger yield than white soy beans, and Italian millet far outranked 5 other varieties grown. At Brandon common red clover gave a heavier yield than alfalfa. Algerian, the leading millet, produced 6.1 tons of hay per acre. At Indian Head in 1904 alfalfa gave much larger yields of hay than several grasses with which it was compared. At Agassiz 3 cuttings of clover were secured for the silo, making a total of 32 tons 1,590 lbs. per acre. Clover was found cheaper for silage than corn.

Miscellaneous.—A report is given on the inspection of different experimental farms and on the growing of winter wheat in Alberta and of different farm crops in the Yukon country. The grades of wheat in the Manitoba inspection division and the most important varieties long under cultivation in Canada are described.

Forage plants and cereals at Highmore Substation, 1904–5 (*South Dakota Sta. Bul. 96, pp. 23–60, figs. 5*).—A brief history and description of the station is given, together with the monthly rainfall records for the years 1888 to 1905, inclusive, and the results of forage plant and cereal investigations for 1904–5 are recorded.

Forage plants, W. A. Wheeler and S. Balz (pp. 23–45).—Of 5 varieties of alfalfa from seed sown May 12, 1905, an average yield of 1,750 lbs. of hay per acre was secured. Oasis stood first with an average yield of 1,930 lbs. The average height of the different varieties was 1 ft. 3 in. In the breeding experiments with alfalfa it was observed that the varieties from Turkestan showed greater variation than those from America or southern Europe. The Turkestan alfalfa produced a larger percentage of coarse, shrubby plants than the other varieties. Owing to an excessive rainfall a good stand of red clover was secured. The barnyard millets were found low in quality and the pearl millets, or Pencillaria, too late for the seasons.

Good results were secured with broom corn, or proso millets, and foxtail millets. Broom corn millets matured in from 75 to 85 days and foxtail millets from 85 to 110 days. In 1904, when July and August were very dry, the broom corn millets matured a small crop of seed, but none of the foxtail millets matured. In 1905 good crops were secured from all varieties tested, the large amount of moisture especially favoring the foxtail varieties. In 1904 the broom corn millets produced an average of 1 bu. 35 lbs. of seed per acre, while the following season they produced 29 bu. 37 lbs. Foxtail millets produced a yield of an average of 42 bu. 22 lbs. per acre in 1905.

In plant-breeding work with millets grown in centgeners the average results for all varieties show an average of 99 days for the growing period, 17 lbs. 13 oz. as a total weight of 100 plants, and 6 lbs. 9 oz. as the weight of seed secured from 100 plants. The growing period ranged from 93 to 103 days and the total weight of 100 plants from 16 lbs. 1 oz. to 20 lbs. 12 oz. The light and dark seeded varieties have been separated for breeding work and their comparison is now in progress.

A large number of introduced and native grasses have been under test, but only *Bromus inermis*, slender wheat-grass, western wheat-grass, wild rye-grass, and wild timothy are considered worthy of further trial. Seed of *Bromus iner-*

mis from 30 or 40 different sources has been tried and quite a difference was noted in the character of the plants from the different lots of seeds. The yields of a one-fourth acre plat of slender wheat-grass were 980 lbs., 908 lbs. and 1,920 lbs. per acre for the years 1903, 1904, and 1905, respectively. The first two years that this plat was started no hay was cut. Wild rye-grass gave results similar to those of slender wheat-grass.

In 1905 experiments were conducted to compare some northern-grown varieties of corn. Of the early varieties Minnesota No. 13 gave the largest yield and produced the best quality of corn. In a series of rotation plats this variety yielded an average of 46 bu. per acre. A plat of flint corn planted May 25 ripened September 26 and yielded 64 bu. per acre. All varieties of sorghum were a failure in 1904 on account of the late drought, but in 1905 a large amount of fodder was produced, and some varieties gave a good crop of seed. Montana No. 341 was the earliest variety grown. In 1905 this variety grew to a height of 9 ft. 8 in., and produced 6 tons and 88 lbs. of fodder per acre.

Cereal investigations, J. S. Cole and S. Balz (pp. 45–60).—This work is carried on in cooperation with the Bureau of Plant Industry of this Department. Earlier results have been previously noted (E. S. R., 16, p. 364). Of durum wheat 49 varieties have been under trial. In 1903 the yield ran from 9 bu. to 20.2 bu. per acre, the average being 14.9 bu., in 1904 from 8.2 bu. to 23.8 bu., with an average of 14.7 bu., and in 1905 from 20.8 to 38.7 bu. per acre, the average being 28.6 bu. The average yield per acre of the 10 best varieties of durum wheat for the three years varied from 20 to 24.4 bu. The leading varieties of other grains and their yields in 1905 were as follows: Pedigree blue stem, common bread wheat, 24.8 bu., Horn barley, 54.4 bu., Sixty Day oats, 64 bu., Emmer No. 1524, 2,410 lbs., winter rye, 25.7 bu., winter wheat, 6.8 bu. The winter wheat was badly winterkilled, but the winter rye made nearly a perfect stand.

Studies were also made on the effects of the immediately preceding crop on the yield of grain in an unfavorable season, and the experience points out that as good a crop of grain can be grown following a well-tended crop of corn as can be grown after the best summer-fallow. In a test with heavy and light seed made in 1905 the heavier seed in every case but one gave the heavier yield. In the average of seven trials there was a difference of 2.17 bu. per acre from an average difference of 14.3 lbs. per bushel in the weight of the seed. In some instances the lighter seed produced a heavier crop of straw but a lighter yield of grain than was secured from the heavier seed.

Agriculture and animal husbandry [field crops], G. H. True (*Nevada Sta. Rpt. 1905, pp. 40–42, pl. 1*).—Brief notes on the station work during the year are presented.

The experiments were conducted in cooperation with this Department, and their purpose was to determine the least amount of water consistent with good growth in growing crops under irrigation. It was found that on the station farm twice as much water is required to grow a crop of alfalfa as in some other localities. On a farm in the Lower Humboldt Valley 3.54 ft. of water were used, while on the station farm the same season 7.60 ft. were applied. It is pointed out that these differences in the amounts of water used are due to the difference in the water-holding capacity of the soil. A yield of 25,919 lbs. of corn fodder per acre was secured with 4 irrigations and a total amount of water equal to about 2.50 ft. One-half acre of potatoes, cultivated once and receiving 6 irrigations aggregating 4.65 ft. of water, yielded 300 lbs. of marketable potatoes less than a one-half acre plat cultivated after every one of 5 irrigations and receiving only 3.64 ft. of water.

In a comparison of the flooding and furrow system of irrigation in growing wheat, the furrowed crop received a depth of 1.705 ft. of water and yielded 2,142 lbs. of grain to the acre, and the flooded tract received 1.42 ft. of water and yielded 2,093 lbs. These experiments duplicated with oats resulted in a better yield from flooding. Kubanka macaroni wheat received 1.85 ft. of water and yielded 1,548 lbs.; Velvet Don, 1.84 ft. of water and yielded 1,274 lbs., and Polish, receiving 2 ft. of water, yielded 1,378 lbs. of grain.

Investigations on the drying of grain, with especial reference to barley, L. Kiessling (*Vrtljschr. Bayer. Landw. Rat., 11 (1906), No. 1, pp. 13–137*).—Similar work by other investigators is reviewed, and the author's results are shown in tables and are discussed at length.

Barley of good germinating capacity, when dried under temperatures ranging from 34 to 98° C., was reduced in germinative power, the greater reductions being shown in connection with the higher temperatures and the longer periods of drying. Of these two factors the temperature exerted the greater influence. A gradual heating was less injurious than a sudden rise of temperature in the barley. The germinative energy was more subject to the influence of heat than the germinative ability, and for this reason the number of sprouted kernels is not considered as a criterion of their viability, as many of them do not live. It is also stated that drying at high temperatures affects the development of the embryo.

Other grains, low in germinative ability, were in some cases improved by heating, but otherwise the effects were the same as with barley. The author points out that on account of the individuality of the seed and the variation in the methods of drying, the data secured in experiments of this kind do not warrant a definite general application.

Tests were also made to study the effect of drying on the germination of immature barley. Immediately after harvesting barley germinates poorly, but it improves from day to day, and generally after having been properly stored for about two months it reaches its maximum germinative ability. The water content of the barley kernel did not seem to influence the rapidity of germination, and when the moisture in the grain was prevented from evaporating its germinative energy was, nevertheless, improved by storing, but this improvement was slower than when the air had access to the stored grain. Exposing the kernels to the rays of the sun also improved the germinative power, and storing for a time in the heads was similarly beneficial. The germinative quality of grain from different varieties, in the same conditions of ripeness and age, varied considerably.

The results of other experiments are regarded as indicating clearly that immediate thrashing after harvesting is likely to reduce the germinative quality of barley, and that it is best to store the crop in the sheaf for several months.

Artificial drying further proved beneficial in retarding fungus growth on the grain. A high water content in barley before drying and a high drying temperature reduced the viability of the sprouted grain, principally in those kernels which were the first to germinate. The general conclusion is drawn that while artificial drying promotes the rapidity of germination it may also reduce the germinative ability, that the curing of barley by going through the sweating process while in storage can not be replaced by artificial heating, and that fresh material under the application of heat must be handled with care, if serious injury is to be avoided.

Preservation of the ability of seeds to germinate, A. Mayer (*Jour. Landw., 54 (1906), No. 1, pp. 51–56*).—An account of an experiment in which seed of

Brassica oleracea, which are rich in fat, and of *Medicago sativa*, poor in fat, were preserved in the presence of burnt lime and of concentrated sulphuric acid or calcium chlorid.

The results of the experiment were as follows: Original germination of the Brassica seed 98; germination 4 years later, when preserved with burnt lime 88; 11 years with sulphuric acid 10.5, and with calcium chlorid 54.8 per cent; water content 6 per cent. With *M. sativa*, not counting the "hard" seed, the following results were obtained: Original germination 88.3; germination with 11 years' preservation with sulphuric acid 79.5, and with chlorid of calcium 85. In the case of *M. sativa* complete drying of the seed with the sulphuric acid had practically no effect on germination, but rather helped to preserve the seed.

With the oily Brassica seeds the results were less favorable, the medium drying in the presence of lime for 4 years giving much better results than complete drying with sulphuric acid. The point is made that the ability of seeds to germinate does not necessarily continually decrease with age, but that this is dependent in considerable measure upon the dryness at which they are preserved.

Experiments in the manuring of a meadow, J. H. STEWART and H. ATWOOD (*West Virginia Sta. Bul. 101, pp. 251–262, pls. 2*).—For 6 years an unfertile upland meadow was treated with barnyard manure and commercial fertilizers, and the yields of hay per acre were increased from a little more than 1½ tons to over 5½ tons.

It was found that both systems of manuring were highly profitable. The barnyard manure, when applied in the fall and thoroughly harrowed in the spring, became so disintegrated and incorporated with the soil that it was not raked up with the hay in harvesting. The use of barnyard manure at $1 per load, when spread upon the meadow, was found to be more profitable than the use of commercial fertilizers, and the annually repeated top-dressing of barnyard manure also left the soil in better condition than the other treatment.

Fertilizer experiments on meadows, A. GRETE (*Landw. Jahrb. Schweiz, 20 (1906), No. 4, pp. 259–286*).—Fertilizer tests were conducted for several years in poor, sandy soil. It was found that with a production of 3,000 kg. of dry matter per hectare a lack of phosphoric acid in the soil became manifest. The insufficiency of potash supply in the soil was also shown when the maximum of production, without the use of potash in the fertilizer, was reached. The third year of the experiment the application of potash was capable of producing in the yield more than 3,000 kg. of dry matter per hectare. The use of nitrogen on these meadows was not profitable.

The quality of the grass was improved through the use of potash and phosphoric acid and reduced when nitrogen was given. The plat receiving potash and phosphoric acid produced in each of the three years the highest quantity of protein. It was observed that 61 per cent of the phosphoric acid and 100 per cent of the potash applied was recovered in the crop. In addition to the potash recovered 1.8 per cent was taken from the soil.

Alfalfa, F. C. BURTIS and L. A. MOORHOUSE (*Oklahoma Sta. Bul. 71, pp. 12*).—In connection with the general directions for alfalfa culture in Oklahoma, fall seeding is recommended, particularly for the less adapted soils. At the station, on a clay loam underlaid by a very stiff, impervious subsoil, an average of 2.32 tons of alfalfa hay per acre were secured during 4 years, the yields increasing from 1.76 tons in 1902 to 3.13 in 1905. On another series of plats, on the same kind of soil, 3.08 tons of hay were secured on an average for 3 years, while a field of about 5 acres gave an average per acre for 4 years of 2.69 tons, the maximum yield in any one year from 5 cuttings being 4.20 tons.

The influence of insufficient potash in the soil on the growth of Phaseolus vulgaris nanus, VON SEELHORST (*Ztschr. Pflanzenkrank., 16 (1906), No. 1, pp. 2–5*).—Observations were made on a series of different crops and it was found that cereals were not much benefited by a large supply of potash in the soil, while beets and potatoes, and especially leguminous crops, particularly this species of Phaseolus, made a much better growth when the supply of potash was large. Where the beans were grown for a number of years on a soil rich in potash, the lower yields secured from year to year showed that the available potash compounds were being reduced. Of all the crops under experiment beans were the most sensitive to lack of potash in the soil.

Alsike clover, H. A. MORGAN and M. JACOB (*Tennessee Sta. Bul., Vol. XVIII, No. 3, pp. 22–27, fig. 1*).—The failure of red clover and the use of alsike as a substitute for this crop is discussed, and general notes on the history and value of alsike clover, together with directions for its culture and its use for hay and pasture, are given.

Correlation in fodder beets, H. BRIEM (*Fühling's Landw. Ztg., 55 (1906), No. 7, pp. 246–253*).—The results of different investigators of this subject are brought together and discussed.

The data presented indicate that of 100 Mammoth fodder beets weighing from 400 to 600 gm. each, 25 specimens contained 9 per cent of sugar; of those weighing from 600 to 800 gm., 28 contained 8 per cent of sugar; and those weighing from 800 to 1,000, 1,000 to 1,200, and 1,200 to 1,600 gm., 39, 31, and 39 individual beets, respectively, contained 7 per cent of sugar. In each case the largest number of beets of a uniform sugar content is presented. It is further shown that with the increase in weight of the beet the percentage of sugar decreases, but that the absolute amount of sugar in the beet increases. In experiments made by Maas beets weighing from 800 to 1,000 gm. contained 58.98 gm. of sugar, or 6.42 per cent, while beets weighing over 2,000 gm. contained 111.36, or 4.80 per cent.

The relation of variety to sugar content was studied by Wohltmann in a series of storage experiments, in which he found differences in the loss of sugar while the beets were in the silo varying from 60 to 20 per cent. In selecting for breeding purposes the same author found that of 6,115 individual beets of the most common varieties, 26 per cent of the Mammoth beets, 15 per cent of the Oberndorf, and 5 per cent of the Eckendorf contained 8 per cent of sugar.

With reference to the relation of the quantity of leaf produced to the sugar content of the beet, Maas concluded from his work that the weight of leaf matter is primarily dependent upon the variety. He found that the percentage of leaf weight decreased as the size of the beet increased, but that the absolute weight of leaf increased. The thickness of the leaf also increased with the weight of the beet. In thick beets the same amount of leaf produced much more sugar than in thin individuals. A strong development of the stalks was unfavorable to the production of sugar. The results further showed that a high sugar content is correlated with early maturity and a thick leaf.

The hop and its constituents, edited by A. C. CHAPMAN (*London: The Brewing Trade Review, 1905, pp. 99, pls. 10, figs. 3*).—In this monograph on the hop plant the topics discussed, treated by different authors, include the physical characteristics of a good hop, fertilization and cross fertilization of the plant, the manuring of the crop, the cold storage of hops, the essential oil, the bitter substances and resins of hops, hop alkaloids, and the part played by hop tannin in brewing.

Oat experiments, R. B. GREIG and J. HENDRICK (*Aberdeen and No. of Scot. Col. Agr. Bul. 6, pp. 28*).—The leading grain-producing varieties in comparative tests were Banner, Thousand Dollar, Newmarket, and Siberian. The older local

varieties in general produced more straw, but the excess of grain was more than equal to the deficiency of straw in the new varieties. A chemical study of the different varieties is reported, and the percentages of husk and kernel in air-dried samples, the composition of the kernels and of the straw are given in tables.

The potato crop, D. YOUNG (*Trans. Highland and Agr. Soc. Scot., 5. ser., 18 (1906), pp. 143–165, figs. 5*).—The history of the potato is reviewed, statistics on the crop given, the process of hybridizing described, and disease resistance of varieties and the spraying and manuring of the crop discussed.

Fertilizer experiments with sugar beets, A. H. DANIELSON (*Colorado Sta. Bul. 115, pp. 23*).—Fertilizer experiments were conducted from 1903 to 1905, inclusive. This work was in part cooperative with the Bureau of Chemistry of this Department.

In 1903 the best financial results were received from the plat treated with 150 lbs. of nitrate of soda per acre. The results of this season further show that the use of 15 tons of cow manure per acre was more profitable than the use of 30 or 60 tons. In 1904 on a different field the most profitable results were secured where 330 lbs. of acid phosphate rock and 165 lbs. of nitrate of soda were applied per acre. The use of nitrate of soda alone, however, gave very nearly as good results. The third year the largest financial returns were secured with 100 lbs. of sulphate of potash and 199 lbs. nitrate of soda were given per acre. The use of 426 lbs. of nitrate of soda alone, however, yielded only 11 cts. per acre less than the plat on which it was applied with the sulphate of potash.

The general conclusion is reached that the soils in question contain ample supplies of potash and phosphoric acid and an excess of lime, while being somewhat deficient in nitrogen and humus. Nitrogen in the form of nitrate of soda was the only element showing a decided effect in increasing the yield over the cost of application. Potash and phosphoric acid in the fertilizer applications seem to neutralize the effect of nitrate of soda upon the yield, although the quality of the beet was good. Applying the nitrate of soda at the time of planting, or in part at this time and in two applications later, gave practically the same results.

The net profit from reasonable quantities of manure seemed to be mainly obtained in the residual effects in the second year, while the third year its use seemed to have no further influence. Refuse lime cake from the sugar factories showed no value as a fertilizer. Soluble fertilizers applied to the seed improved the germination. It was found that the tops were about 44 per cent of the weight of the clean beets. A 15-ton crop, therefore, produces 6.6 tons of fresh green tops, which will air-dry to about one-eighth of the original weight, or 0.8 of a ton.

The influence of stripping on the yields of cane and sugar, C. F. ECKART (*Hawaiian Sugar Planters' Sta., Div. Agr. and Chem. Bul. 16, pp. 24, dgms. 4*).—Three series of experiments on the influence of stripping sugar cane are given, and the results indicate that in some instances the process is profitable, while in others it is not. The data are regarded as showing that careful field experiments should be carried out on each plantation, to determine whether or not the dry leaves may be economically removed from the cane, and plans for carrying out such experiments are outlined.

Experiments with fertilizers on tobacco, C. E. THORNE (*Ohio Sta. Bul. 172, pp. 215–230, dgm. 1*).—The plan of these experiments from previous results have been heretofore shown (E. S. R., 17, p. 245).

While the work has not been carried on far enough to justify definite conclusions, the latest results indicate that for tobacco on soil in the Miami Valley the use of barnyard manure is more profitable than the use of commercial fertilizers, but where it is not obtainable commercial fertilizers may be substituted with excellent temporary effect, but with a reduced net profit as compared with the use of the manure. The results at this stage also appear to show that the greatest total yield is secured from the use of an application containing relatively more phosphorus in proportion to nitrogen than is found in ordinary barnyard manure. Potash in the fertilizer regularly increased the yield, but at very small profits, and when barnyard manure is used the application of potash, in a commercial form, becomes necessary. As a carrier of nitrogen, sodium nitrate appeared to be much more effective for tobacco than tankage.

Turnip experiments, 1904, J. HENDRICK and R. B. GREIG (*Aberdeen and No. of Scot. Col. Agr. Bul. 4, pp. 36, dgms. 2*).—The results of cooperative fertilizer experiments indicated that on the soils in question, of which the chemical and mechanical analyses are presented, potash is more important than nitrogen for turnips.

Superphosphate or basic slag, or a mixture of the two, seemed to be the most profitable source of phosphoric acid. It is stated that in a good year a complete dressing of commercial fertilizers in medium quantity, with 10 tons of barnyard manure, will give satisfactory returns. More than 10 tons of barnyard manure is not recommended. Ground lime, applied when the turnips are sown, generally decreases the crop. Chemical analyses were made of different parts of the turnip, and it was found that the upper half contains a higher percentage of dry matter than the lower, and that the outside part next the rind is richer in dry matter than the inner part.

Nitrogenous manures for turnips, R. P. WRIGHT (*Trans. Highland and Agr. Soc. Scot., 5. ser., 18 (1906), pp. 93–109*).—The results of cooperative experiments for several years are reported and the conclusion is drawn that the largest increase in crops may be secured by applying one-half of the nitrogenous manure in the drills in the form of sulphate of ammonia, and the other half as a top-dressing in the form of nitrate of soda.

Culture experiments with vetches, F. G. STEBLER and A. VOLKART (*Landw. Jahrb. Schweiz, 20 (1906), No. 4, pp. 243–258, pl. 1*).—A comparative test of different species and varieties of vetches secured from different countries is reported. Brief notes on various species are given.

The results secured indicated that the yield of summer vetches depends very largely upon the time of sowing the seed, the best results being obtained from early sowing. Field peas were not found equal in value to vetches as a catch crop. It is pointed out that satisfactory results can be obtained only from good, pure seed. The heaviest yields were secured from vetches obtained from Alsace, Hungary, and Burgundy. Bulgarian vetch was one of the least satisfactory.

Fertilizer tests with wheat and corn, H. SNYDER (*Minnesota Sta. Bul. 94, pp. 165–187*).—Nitrogen, phosphoric acid, and potash fertilizers were applied, singly and in combination, to one-fourth acre plats of wheat to determine the influence of these fertilizers on the character of growth and on the yield. In these experiments 150 lbs. of a complete fertilizer, containing 1.68 per cent of nitrogen, 15.46 per cent of phosphoric acid, and 1.9 per cent of potash were used. The phosphate fertilizer consisted of 80 lbs. per acre of treated rock phosphate, containing 17.56 per cent of phosphoric acid, and the potash fertilizer of 40 lbs. of kainit, containing 13.5 per cent of potash. Nitrate of soda, containing 15.06 per cent of nitrogen, was used in quantities of 40 lbs. per acre. The complete

fertilizer was valued at $25 per ton, the acid phosphate at $15, the nitrate of soda at $50.

These experiments were cooperative and were conducted in different counties in the State and at the station. On an old soil, reduced through excessive grain culture, the use of commercial fertilizers did not result in raising the yield more than 3.6 bu. per acre. On a grain-cropped soil, where clover had been grown, phosphoric acid and potash increased the yield, while nitrogen did not prove economical. In one experiment phosphoric acid alone caused an increase in yield of 4 bu. per acre, and in other tests its use produced a better stand of clover. At the station, on land producing 27 bu. of wheat per acre without fertilizers, the use of commercial fertilizers gave no appreciable increase. The application of nitrogen to old and exhausted wheat soils increased the protein in the grain from 1 to 3 per cent.

In the tests with corn, potash in three cases gave beneficial results, but insufficient to pay for its cost. Better results were secured from barnyard manure than from the commercial fertilizers.

From the one season's work no definite conclusions are drawn, but the results indicate that commercial fertilizers should not be used indiscriminately on old soils for the purpose of increasing the yield.

Some common weeds and their eradication, A. D. WILSON (*Minnesota Sta. Bul. 95, pp. 193–237, figs. 25*).—A general discussion on the methods of avoiding and eradicating weeds is given, with brief notes on the more common species.

At the station wild oats from the crop of 1905 were planted in September of that year and 70 per cent germinated. A large percentage of wild mustard and wild barley also germinated under the same treatment. It is pointed out that by facilitating the germination of these weeds in the fall they may be killed by frost and by subsequent cultivation. In another test 3 lbs. of rape seed sown per acre in cornfields at the last cultivation produced an excellent crop of rape and prevented the growth of pigeon grass or other weeds. Hemp sown thickly on a piece of ground infested with quack grass did not quite eradicate this weed. The use of 6½ gal. of kerosene per square rod was inefficient in destroying quack grass, and the same was true of the use of 80 bbls. of salt per acre. A 15 per cent solution of sulphuric acid, at the rate of 40 to 50 gal. per square rod, killed the plants, but this treatment is also too expensive to be practical. Covering the grass with tar paper apparently killed it, but this method, also, is too costly.

HORTICULTURE.

Horticultural work at the Canada experiment stations, W. T. MACOUN, W. S. BLAIR, S. A. BEDFORD, A. MACKAY, and T. A. SHARPE (*Canada Expt. Farms Rpts. 1905, pp. 91–116, 121–124, 302–309, 312–320, 346–355, 380–394, 415–438*).—The results of cultural experiments are reported with a large number of flowers, fruits, and vegetables grown on the experimental farms in Canada. The data are similar in character to those reported in previous years (E. S. R., 17, p. 139). Much miscellaneous information on the general work of each of the stations during the year is also included.

W. T. Macoun, at the central farm, reports the results of the examination of 30 seedling fruits of various kinds. Descriptions are given of 27 new or little-known varieties of apples in Ontario and Quebec. The net profits in the closely planted Wealthy apple orchard previously reported upon, amounted to $103.13 per acre in 1905. This makes the average net profit since the orchard has been bearing over $105.75 per acre, and since the orchard was started, $59.03 per acre.

It will be remembered that the trees in this experiment are Wealthy and that they are set 10 ft. apart each way.

Some results of experimental shipments of apples to Glasgow in 1905 show that Wealthy apples brought the same price whether packing material was used or not. A table is given showing the yields of individual trees of Wealthy, McMahan, McIntosh, and Patten Greening apples for each of the years 1898 to 1905. Scions are being selected for propagation from the most productive trees. Twelve varieties of new black currants, originated from seedlings, are described, and a table given showing the results of a test of 50 varieties of strawberries.

Two new formulas are given for making kerosene emulsion. In one freshly slaked lime is used, and in the other flour. It is found that a perfect emulsion can be made by slaking one-half pound of good quicklime and emulsifying with 1 qt. of kerosene to 2 gal. of water from 3 to 5 minutes. It does not appear to be a matter of much moment whether the lime be dry and powdery when mixed with the kerosene or not, as kerosene emulsions have been made from both air slaked and freshly slaked lime, the lime being made into a thin cream with water before adding the kerosene. When flour was used it was found that 8 oz. was sufficient to hold in suspension 1 qt. of kerosene, and even 2 oz. would make a temporary emulsion for immediate use. If the flour was scalded before adding the kerosene, 2 oz. of flour was sufficient to make an emulsion that would stay up for more than a week. The flour emulsion is considered the more useful where it is not desired to discolor the trees on which it is used.

Some data are given of experiments in pruning tomatoes in the field, which indicate that earliness is considerably increased by pruning, and that the total yield is slightly greater from plants pruned once than from plants pruned twice. In fact, the total yield from plants pruned twice was not quite so great as from unpruned plants.

W. S. Blair, at the Nova Scotia station, found that in garden practice it is a decided advantage to stake even half tall varieties of peas and to plant two rows 6 in. apart, allowing 2 ft. space to the next row. This is much preferable to a single row 2.5 ft. apart, since about double the crop is secured. There is more difficulty in hoeing the double rows, and in field plantings it could not be practiced. Pods from the staked peas were much superior to the unstaked peas.

Tomato plants pinched back slightly did not give so large a yield as when not pinched back.

At the Manitoba station S. A. Bedford reports the fruiting of 2 varieties of standard apples, Hibernal and Duchess of Oldenburg. The Hibernal tree was root-grafted on Siberian crab in 1901, while the Duchess of Oldenburg was top-grafted on Siberian crab. Native Manitoba plums have been found much earlier than any of the other plums grown at the station, many of them ripening their fruit August 15.

In experiments in planting maple seed, a row 270 ft. long planted in the spring produced 2,600 trees, while rows of the same length, when planted in the fall, produced only 900 trees.

Report of the horticultural division of Mustiala Institute, 1894–1904, K. Stening (*Landtbr. Styr. Meddel., 51 (1905), pp. 73, pls. 22*).—The report gives a brief account of the history of the division, with a description of the horticultural grounds of the institute, kinds of crops grown and value of different varieties, methods of culture, insect and fungus enemies, etc. A number of excellent half-tone reproductions of fruit trees and views of the grounds are included in the report.—F. W. WOLL.

Vegetable Growers' Association, Province of Ontario (*Ann. Rpt. Veg. Growers' Assoc. Ontario. 1 (1905), pp. 48*).—The history of the formation of the society, which occurred March 25, 1905, is noted, the constitution and by-laws of the association given, and the papers read before the association on a large number of subjects relating to vegetables and their culture.

The home vegetable garden, W. R. Beattie (*U. S. Dept. Agr., Farmers' Bul. 255, pp. 47, figs. 34*).—Some considerations are given on the location of the garden and its general arrangement, methods of preparing the soil, and the use of fertilizers, construction of hotbeds, seedbeds, etc., with detailed cultural directions for all the more common vegetables grown in the garden. The bulletin concludes with a planting table, in which the quantity of seed or number of plants required for 100 ft. of row, distance to plant, times for planting, and period required for the maturing of the crop are indicated.

The farmer's garden (*Bul. Maine Dept. Agr., 5 (1906), No. 1, pp. 42, fig. 1*).—Popular directions are given for the garden planting of fruits and vegetables, with a number of papers from growers in different sections of the State setting forth the value of the home garden.

Vegetable growing in Porto Rico, H. C. Henricksen (*Porto Rico Sta. Bul. 7, pp. 58, pls. 10, figs. 2*).—Popular directions, based on the results of a season's work in which 6 plantings of vegetables were made 2 months apart, are given for a large number of vegetables. In general, it is shown that by proper cultural methods practically all the vegetables grown in temperate regions can be successfully grown at the station. The bulletin also contains a brief discussion of the principles of soil preparation and cultivation, the use of fertilizers and manures, the planting of seeds and the handling of seedlings, and the spraying of plants for the control of insect pests and fungus diseases.

Cucumbers, L. C. Corbett (*U. S. Dept. Agr., Farmers' Bul. 254, pp. 30, figs. 14*).—Popular directions are given for growing cucumbers for early market in the open and in cold frames, growing cucumbers for pickling purposes, and for forcing cucumbers under glass. Treatment of the plants for the control of insect pests and fungus diseases is also considered.

The wild melon and the culture of melons in Central Asia, J. Barsacq (*Jardin, 20 (1906), No. 466, pp. 213–216*).—In addition to a general discussion on melons in Central Asia, detailed observations are given on about 30 of the best known varieties, in which the time of maturity of each variety, average weight, quality, and keeping quality are considered.

Electricity as applied to agriculture (*Gard. Chron., 3. ser., 39 (1906), No. 1006, pp. 217, 218*).—It is stated that the effect of electricity on the growth of different cereals, fruits, and vegetables is being tested on an extensive scale at Pitchill and Bevington, in England.

In all 19 acres are being treated. Over this area high poles have been erected and from these, at a height of 16 ft., wires have been suspended. The electrictiy is discharged from these wires, the current being generated by a dynamo driven by a three-horsepower oil engine. Wheat and barley are the principal crops that are being grown, and a 25 per cent increase in yield is expected.

A case of persistent vitality in seeds, B. Landreth (*Proc. Amer. Phil. Soc., 45 (1906), No. 182, pp. 5–8*).—Seeds taken to Fort Conger, about 490 miles from the pole, by the Greeley expedition in 1883 were found in 1899 by the Peary party and sent to the United States, where they remained unplanted until the spring of 1905, when a package each of lettuce and radish seed were planted. The lettuce seed failed to germinate, but about one-half of the radish seeds grew to perfection and reproduced seed.

The Thays process for germinating seeds of maté, C. THAYS (*Jour. Agr. Trop., 6 (1906), No. 61, pp. 203-205*).—The author has met with considerable success in germinating seeds of Paraguay tea (*Ilex paraguayensis*) by soaking in hot water, and gives results of a number of experimenters who have used this method. One man reporting on the subject states that when the seeds were placed in water at 80° C. and soaked for 6 hours, then the hot water renewed for a period of 4 days, a germination of 57 to 63 per cent was obtained.

The chemical composition of fruits, E. HOTTER (*Ztschr. Landw. Versuchsw. Österr., 9 (1906), No. 7, pp. 747-800*).—Food constituents of the fruit and ash analyses are given for a large number of orchard and small fruits, including such fruits as elderberry, Japanese wineberry, mulberry, mountain ash, medlar, and all the usual fruits cultivated in garden and orchard. The article constitutes part 3 of an investigation on the marmalade industry, previously noted (E. S. R., 16, p. 689).

Specific requirements of new varieties in California fruit growing, E. J. WICKSON (*Pacific Rural Press, 72 (1906), No. 3, pp. 36, 37*).—The text of a paper presented at the convention of the American Association of Nurserymen at Dallas, Texas, is given.

California growers, shippers, and canners were consulted by means of circular letter, and the replies from 1,601 of these were used as a basis for the paper. It appears that 5 varieties of apples lead all others in California. These are the Yellow Newtown Pippin, Yellow Bellefleur, White Winter Pearmain, Gravenstein, and Red Astrachan. Of apricots Royal is decidedly in the lead. The same is true in the case of the Napoleon Bigarreau, a cherry locally known as Royal Ann. The Bartlett is of greater importance among the pears than all other varieties in California combined. The foremost of the California plums is Wickson. Eureka is the best variety of lemons grown, while Washington navel and Valencia are the best oranges.

The specific needs of fruit growers in the way of new varieties of each of these fruits, as well as of prunes, grapes, etc., are considered in detail.

Fruit division (*Rpt. Min. Agr. Canada, 1905, pp. XVIII-XXI*).—The text of the act relative to the packing and sale of Canadian fruits, with an account of the administration of the law during the year. The fruit of 811 packers, containing 212,348 packages, was inspected. Of this number 10,798 packages were actually inspected.

Dependable fruits, W. J. GREEN and F. H. BALLOU (*Ohio Sta. Circ. 55, pp. 4*).—A list is given of various orchard and small fruits which are most likely to succeed in different sections of the State.

Orchard culture, W. J. GREEN and F. H. BALLOU (*Ohio Sta. Bul. 171, pp. 189-215, figs. 18*).—Results are given of a comparative test, extending over a period of 6 years, of different methods of cultivating apple orchards.

On one plat of 40 Jonathan and Grimes trees the usual method of clean cultivation early in the season, followed by a fall cover crop, was observed. On a second plat clean cultivation was given throughout the season. On a third the trees were set in sod and the ground kept cultivated in a circular area 3 to 4 ft. in diameter about each tree. The grass between the trees was cut 3 or 4 times during the season and allowed to lie in place. On a fourth plat the trees were likewise set in sod, but were not cultivated. At the time of planting they were heavily mulched with straw. The grass between the trees was cut 2 or 3 times during the season, raked up and distributed around each tree as a mulch.

The plat which was given clean cultivation throughout the entire season washed so badly that this part of the experiment had to be discontinued at the end of the fourth season. Hence this method of cultivation is not recommended

for Ohio conditions. The average girth of the trees in each of the remaining plats and the average weight of apples secured are shown in the following table:

The growth and yield of apple trees by different methods of culture.

Method of culture.	Average girth of trees.	Average yield per plat.
Clean culture followed by—	*Inches.*	*Pounds.*
Cover crops	9.71	22
Sod culture	8.55	7
Sod and mulch	10.56	43

The table brings out the fact that the best results, as regards both growth and yield of fruit, have been obtained by the sod-mulch method of culture.

It has been claimed that in orchards receiving clean cultivation early in the season, followed by a cover crop, the root system develops to a greater depth and is consequently less injured by drought, heat, and cold than by the mulch system. The authors examined numerous cubic-foot areas of soil from the different plats with reference to development of roots, examining first a 2-in. layer, then the next 4 in., and finally the bottom 6 in., separately. "The main root systems of apple trees, under the different methods of culture, were found to be at a surprisingly uniform depth, the greater portion of the roots, both large and minute, being removed with the upper 6 in. of soil."

On the plat given clean culture, followed by cover crops, it was found that thousands of feeding rootlets penetrate upward to the very surface of the soil, where they actually come in contact with cultivator or harrow, while but very few of these rootlets penetrate to the lower, more compact, colder soils. Each season these feeding rootlets are cleanly pruned away by the plowshare, without apparent injury to the trees or crops, since they have performed their function and their places are occupied the succeeding season by a new generation.

A very dense network of feeding rootlets was also found on the surface of the soil beneath the heavily mulched trees. These rootlets also penetrate the lower layers of the mulch itself. There appeared to be, however, fully as many feeding rootlets in the upper 6 in. of the soil itself as was the case when the soil was given clean cultivation throughout the early part of the season. It is held, therefore, that since the main root system forms at as great a depth under the mulch system as when the crop is given clean cultivation, and since the feeding rootlets are just as numerous in the soil itself, the removal of the mulch, or even a change from heavy mulching to the clean culture cover-crop plan, would not be as disastrous as has been generally supposed. The destruction of the surface rootlets and of those that penetrate the mulch, either by cold, drought, or heat, is therefore no more serious a matter than is the destruction of the rootlets in the clean cultivated soil by the plow.

The authors state that "under the 'sod-mulch system' of culture the trees have uniformly made a heavier, more vigorous growth than under any other system of culture. This is no doubt due to the certainty and uniformity of the generous store of fertility right at hand—the concentration of an abundance of plant food where it is most available and the consequent presentation of conditions, beneath the mulch of vegetable matter, especially favorable to a healthy, unstinted, continuous nourishment of the trees."

Cover crops for young orchards, R. A. EMERSON (*Nebraska Sta. Bul. 92, pp. 1–23, pls. 2, figs. 8*).—A summary is here given of experiments which have been carried on since 1899 in the use of cover crops in young orchards. Part of the data here given have been previously noted (E. S. R., 14, p. 1066).

The author shows that the factor of first importance in protection against winter injury is the securing of hardy varieties; second, the selection of a comparatively high site for the orchard; and, third, the use of cover crops, which dry out the soil early in the fall and induce early maturity. In the State of Nebraska cover crops must be considered primarily from the standpoint of their effect on the soil moisture, rather than from their fertilizing value.

The author thus sums up the requirements of an ideal orchard cover crop for Nebraska: "It should start growth promptly in order to insure an even stand and to choke out weeds. It should grow vigorously to insure a heavy winter cover and to dry the ground in case of late-growing trees, so as to hasten their maturity. It should be killed by the early frosts so that it will stop drying the ground after danger of late tree growth is passed, and to help conserve our light fall rains, so much needed by the trees in winter. . . . A cover crop should be heavy enough to furnish as good direct protection as possible against freezing and thawing of the ground, and it should stand sufficiently erect to hold snow against the power of strong winds. . . . Finally, in case of poor soils or of old and feeble trees, the cover crop should be a leguminous one, in order that it may add to the store of nitrogen in the soil, and thereby increase the vigor of growth of the trees."

This excludes from use such crops as rye, winter wheat, vetches, and clovers which live over winter, and late-growing crops, like field peas, rape, oats, and barley. Of the crops killed by early frosts the most satisfactory have been corn, cane, and millet. These crops start promptly into growth in midsummer, choke out the weeds, dry out the ground, and make an erect winter cover which holds the snow fairly well. In dry falls, corn makes a poorer growth than cane or millet.

"Millet makes a good cover if it can get six weeks of growth before frost. It stands nearly erect and thus holds the snow well, and is so leafy that it affords fair winter protection even without snow."

A number of tables are given showing the effect of various cover crops on soil and moisture in both the spring and fall, on the depth to which the ground is frozen underneath them, and their effectiveness in holding snow. Crops which stand erect catch the snow and hold it, and the ground freezes to a less depth underneath than crops which mat down. A good covering of snow is one of the most effective means of preventing alternate freezing and thawing of the ground, and also prevents the ground from freezing so deeply.

Picking, packing, and marketing the apple, L. B. Judson (*Idaho Sta. Bul. 54, pp. 37, pls. 17*).—Popular directions are given for the harvesting, picking, and marketing of apples, including an account of packing houses and fittings, and directions for organizing fruit growers into associations to secure better packs and higher prices. The appendix contains a circular of advice to growers and packers distributed among the members of the Hood River Apple Growers' Union, the text of the Canadian Fruit Marks Act of 1901, and the articles of incorporation and by-laws of the Hood River Fruit Growers' Union.

Relative to the time of harvesting apples, the author calls special attention to the necessity of harvesting Jonathan apples when the seeds have turned a light brown. If the fruit is not picked until well colored and the seeds are dark around the edges, it is likely to rot at the core while still sound on the outside.

Orange cultivation in the Khasi hills, B. C. Basu (*Agr. Jour. India, 1 (1906), No. 1, pp. 62–67*).—About 100 square miles of the Khasi hills are suitable for orange cultivation. The oranges grown are known to the world as the Sylhet oranges, and are produced entirely from seedlings, which bear at the end of about 7 years. The general methods of culture are given in detail.

A Louisiana plant breeder, J. L. Norman (*Nat. Nurseryman, 14 (1906), No. 6, pp. 183, 184, fig. 1*).—The author describes his method of breeding hardy oranges and the umbrella mulberry originated by him.

The wild apricot or wild peach (*Transvaal Agr. Jour., 4 (1906), No. 15, p. 617, pl. 1*).—A colored plate is given of the fruit of *Landolphia capensis*, commonly called the wild apricot or wild peach. The fruits are edible, with a pleasant acid flavor, and are said to make good jelly, brandy, and vinegar.

The dried banana, P. Ammann (*Agr. Prat. Pays Chauds, 6 (1906), No. 38, pp. 381–389, figs. 4*).—A discussion of the commercial future of dried bananas, with the results of experiments in drying bananas with two different forms of evaporating machines.

It appears that there is a loss in peeling bananas of about 35 per cent of their original weight. In one experiment 5 kg. of peeled bananas gave 1.5 kg. of dried bananas, and in another 1.38 kg. A larger portion of dried bananas was obtained from the use of mature fruit than from slightly green or overripe fruit. Analyses are given of two samples of banana flour.

Statistics on the German fruit industry (*Jahrb. Deut. Landw. Gesell., 20 (1905), pp. 142–164*).—Statistics are given showing the acreage and number of the different kinds of orchard fruit trees in various provinces of Germany.

Fertilizer experiments with cacao, L. Strunk (*Tropenpflanzer, 10 (1906), No. 8, pp. 516–535*).—A number of different fertilizers and combinations were used on cacao. The heaviest yield of unfermented fruit was obtained on a plat in which each tree was fertilized with 1,000 gm. kainit, 480 gm. superphosphate, and 240 gm. sulphate of ammonia. When 1,000 gm. of slaked lime were used instead of superphosphate in the formula, or when the sulphate of ammonia was omitted entirely, the yields were about 12 per cent less. The details of the experiment are given for each plat monthly from April to November in tabular form, with the analyses of the soil on which the experiment was conducted.

The grape trellis, T. V. Munson (*Texas Farm and Ranch, 25 (1906), No. 32, p. 2, figs. 2*).—The author describes an improvement of what is known as the Munson three-wire canopy trellis, giving illustrations. The improvement consists primarily in the methods of tying on the cross pieces of the posts, and in grounding the wires to prevent injury to the fruit from lightning.

How to make a fruit garden, S. W. Fletcher (*New York: Doubleday, Page & Co., 1906, pp. XIX+283, pl. 1, figs. 190*).—This book contains popular directions for the planting and care of all of the common orchard and small fruits, including subtropical fruits, and for the harvesting and storage of the same. Methods of treating insect pests and fungus diseases and varieties especially adapted to the home garden in each of the different States are considered. The appendix contains numerous formulas relative to spraying material, grafting wax, rules for the exhibition of fruits, etc. Many new illustrations add greatly to the value of the work, which is intended primarily for the amateur in fruit growing.

Common sense gardens, C. V. V. Sewell (*New York: Grafton Press, 1906, pp. 396, pls. 72, figs. 23*).—The author discusses methods of laying out home grounds and of planting them. The merits of various trees, shrubs, and flowering plants for ornamental purposes are considered in detail, as well as such matters as walks, walls, water, and the harmonious arrangement of all of these with the home.

Carnations, picotees, and pinks, H. W. Weguelin (*London: W. H. & L. Collingridge, 2. ed., rev., pp. VIII+104, pls. 7, figs. 24*).—This work is devoted primarily to the culture of these flowers outdoors.

FORESTRY.

On the rate of growth and yield of forests in Västerbotten County, Sweden, G. Beronius (*Skogsvårdsför. Tidskr., 4 (1906), No. 1, pp. 1–15, map 1, dgms. 2*).—The author finds that the percentage increment of the pine and spruce forests in this region of about 25,000 hectares amounts to 1.9 per cent or 1.03 cubic meters per hectare, ranging from 2.7 to 1.3 per cent for the different types of forest. The total yield is calculated to be on an average 0.96 cubic meter per hectare of productive area or over 16,000 cubic meters for the forests surveyed.—F. W. WOLL.

Observations on afforesting moor lands, H. Liechti (*Schweiz. Ztschr. Forstw., 57 (1906), No. 5, pp. 141–151, pls. 2, figs. 5*).—The successful afforestation of moor lands with spruce, pine, etc., is described and illustrated.

Deforestation in China, B. Willis (*Proc. Soc. Amer. Foresters, 1 (1906), No. 3, pp. 141–146, pl. 1*).—A discussion of the general forest situation in China with special reference to the deforested regions in northern China.

Growing locust in Hungaria, A. Gaskill (*Forestry Quart., 4 (1906), No. 4, pp. 106–111*).—The author studied the methods of growing locust in the forests lying in the Great Danube plain about 100 miles south of Budapest where conditions seem to be somewhat similar to those found in the eastern part of our plains region. A money return of about 2½ per cent on land valued at $20 per acre is secured. Tables are given showing the stands of seedling and second growth locust on sample plats of 1 acre each and of the yield of locust sprout forests of the first, third, and fourth classes.

Rocky Mountain seedling growth, J. C. Blumer (*Forestry Quart., 4 (1906), No. 2, pp. 98–105*).—A number of observations on the reproduction of forest trees in the Pike's Peak Forest Reserve were made.

The principal species of trees in this district are conifers, and of these, bull pine, red fir, limber pine, and Engelmann spruce are most numerous. The seed of all these species needs bare mineral soil on which to germinate. Attention is called to the great density required for natural pruning in the Engelmann spruce. "Trees 3 or 4 in. in diameter, 15 to 20 ft. high, and 40 years old, must usually stand not over 1 ft. apart in order to lose their branches up to 3 or 4 ft. from the base."

Germination period of some conifers, E. Zederbauer (*Centbl. Gesam. Forstw., 32 (1906), No. 7, pp. 306–315*).—A large number of tests were made of the time required for germination of seeds of different species of conifers. With most of the species of Picea, Pinus, Larix, Tsuga, Sequoia, Douglasii, Cryptomeria, and Cupressus, the period of germination varied from 14 to 28 days, and of *Pinus strobus* from 30 to 40 days after placing in the germination apparatus.

Germination tests and valuation of pine seeds, Haack (*Ztschr. Forst u. Jagdw., 38 (1906), No. 7, pp. 441–475, pl. 1*).—In continuation of previous work (E. S. R., 17, p. 370) the author made extensive investigations to determine (1) how the various forms of pine seedlings which appear in germination tests are to be judged with reference to the value of the sampled seed, (2) the influence of light on the germination of pine seed, (3) the relation between laboratory tests and the percentage germination actually obtained under field conditions, and (4) the effect of different degrees of temperature and different amounts of moisture on the germination of pine seed.

It was found in the first place that many seeds which germinate should not be counted as such in germination tests because the germs are so weak that they never produce plants. Illustrations are given showing many of these weak

seedlings. For the larger percentage of pine seeds the optimum germination temperature is 24° C. The total percentage of germination, as well as the energy of germination, was less in darkness than in light. The poorest results were secured with blue light, while yellow light stood next to daylight in value. The strength of the light also had considerable influence.

Seed which gave 95 per cent germination in the laboratory gave but 39 per cent under unfavorable conditions out of doors, and seed which gave 60 per cent germination in the laboratory gave but 3 per cent germination out of doors, showing that the difference observed in germination tests in the laboratory is not a measure of their relative values for out of door planting. It was also found that the seed which germinated with greatest energy under favorable conditions produced more plants when sown out of doors than seed which gave the same percentage of germination but were not so vigorous.

The data secured in drying seeds at different degrees of temperature and in atmospheres saturated to different degrees of moisture correspond closely to that previously reported (E. S. R., 17, p. 370). Seed held at a temperature of 80° C. in an atmosphere saturated with 59 gm. of water per cubic meter were not noticeably injured. Seed dried in an atmosphere containing from 90 to 105 gm. per cubic meter were injured in a temperature of 56° C. When the moisture was raised to 190 to 296 gm. per cubic meter the seed was entirely killed, which, when dried in an atmosphere containing 59 gm. per cubic meter was not injured.

The life history of Pinus sylvestris, A. W. BORTHWICK (*Trans. Roy. Eng. Arbor. Soc., 6 (1905–6), pt. 2, pp. 205–223, pls. 4*).—A monograph on the Scotch pine, including an account of the fungus insects affecting it.

Ficus elastica, its natural growth and artificial propagation, E. M. COVENTRY (*Calcutta: Govt., 1906, pp. VI + 35, pls. 3*).—This bulletin embodies primarily what has been learned in Assam regarding the growing of *Ficus elastica*. Account is given of the methods of culture and preparation of the rubber for market.

The science of para rubber cultivation, H. WRIGHT (*India Rubber Jour., n. ser., 32 (1906), No. 3, pp. 140–144*).—A paper on this subject, read before the Kegalla Planters' Association in Ceylon, with the discussion following.

A compilation of notes on India rubber and gutta-percha, G. P. AHERN (*[Philippine] Bur. Forestry Bul. 3, pp. 40, figs. 2, map 1*).—A large amount of material relative to the culture, preparation, and uses of Ceara, Castilloa, and Para rubber is here brought together.

Experiments with rubber-yielding plants in Dominica, J. JONES (*West Indian Bul., 7 (1906), No. 1, pp. 16–20, figs. 3*).—The results secured at the botanic station in growing and tapping *Castilloa elastica* and *Funtumia elastica* are reported upon. The results indicate that Castilloa is more wind resistant and less subject to injury than Funtumia, and therefore better suited to culture in the island.

Rubber experiments in St. Lucia, J. C. MOORE (*West Indian Bul., 7 (1906), No. 1, pp. 21–29, figs. 3*).—Some data are given on tapping experiments with *Castilloa elastica*. The trees were 15 to 17 years old and the average yield of rubber obtained was 11.66 oz. per tree.

What are the essentials of a State fire law? E. A. STERLING (*Proc. Soc. Amer. Foresters, 1 (1906), No. 3, pp. 132–140*).—A paper on this subject delivered before the society in 1904.

The creosoting of home-grown timber, W. B. HAVELOCK (*Agr. Students' Gaz., n. ser., 13 (1906), No. 1, pp. 13–16*).—A table is given showing the results of tests to ascertain the absorption of creosote oil under high pressure by 56 kinds of timber.

The timber was sawn to different sizes, seasoned in the open air, and the oil injected under a pressure of 80 to 85 lbs. per square inch for 3 hours. The creosote was warmed by steam during use and a vacuum of 9 lbs. was obtained in the cylinder before the oil was injected. The table shows the absorption of creosote per cubic foot of the wood impregnated.

Big returns from growing trees, F. BURNS (*Farming, 1 (1906), No. 5, pp. 176, 177, figs. 6*).—Financial statements are given of results obtained from a well-managed woodlot in Pennsylvania and of another in Nebraska.

DISEASES OF PLANTS.

New and little-known plant diseases in Nebraska, F. D. HEALD (*Abs. in Science, n. ser., 23 (1906), No. 590, p. 624*).—Notes are given on the following diseases:

(1) Twig-girdle of the apple due to a Phoma-like fungus. (2) Trunk rot of the cherry due to *Schizophyllum commune.* A small orchard of trees 5 to 6 years old was completely destroyed by this fungus. (3) Wheat leaf fungus (*Leptospharia tritici*). Among other things, its distribution over the same area as the Hessian fly was noted. (4) Bacterial leaf blight of wheat. A bacterial blight of the leaves was common on the leaves of wheat in the breeding plat at the experiment station and was also observed elsewhere. (5) Bacterial blight of soy bean. This disease was quite serious on soy beans used as an orchard cover crop at the experiment station. (6) Moldy corn due to a fungus provisionally referred to *Diplodia maydis,* but differing in several points in habit and structure.

Report of the consulting botanist, W. CARRUTHERS (*Jour. Roy. Agr. Soc. England, 66 (1905), pp. 162–173, figs. 2*).—After brief accounts of the purity and germination of clover and grass seeds and the enumeration of species of poisonous and troublesome weeds, the author describes a number of diseases of plants which were observed during the year.

The principal of these were diseases of potatoes, and the observations are briefly summarized regarding the *Nectria solani,* potato scab, potato canker hitherto ascribed to *Chrysophlyctis endobiotica,* a wart disease, the early blight caused by *Macrosporium solani,* and two bacterial diseases of potatoes, one attributed to *Bacillus solaniperda,* the other to *B. phytophthorus.* Recent observations place the fungus Chrysophlyctis with Œdomyces. Notes are given on a number of other miscellaneous diseases.

The rusts of Australia, D. MCALPINE (*Melbourne: Dept. Agr. Victoria, 1906, pp. VIII + 349, pls. 55, figs. 28*).—This publication treats of the structure, nature, and classification of the rusts of Australia, all the species known to occur being included in the book. Those which are not native to the country are specially designated, and all the species are figured so far as specimens were available.

This monograph is preliminary to a study of methods of preventing the appearance or limiting the spread of rusts on numerous commercial crops. The first part treats of the different stages of the rusts and their relation to the host plants and to other fungi, and a chapter is devoted to the present position of rust in relation to wheat production in Australia. In the second part of the book classifications and technical descriptions are given of the different species. An extensive bibliography of literature completes the work.

Infection of plants by rust fungi, W. L. BALLS (*New Phytol., 4 (1905), No. 1, pp. 18, 19*).—The author notes having observed that the germ-tubes of spores on infected leaves radiated from the spore if the surrounding atmosphere was kept well saturated, and this suggested that water vapor might be the body in search of which the fungus entered the stomata.

In another publication (E. S. R., 16, p. 885) it has been shown that the first entrance of the germ-tube was probably due to some positively chemotropic body which is common to all plants. To determine the identity of this substance the author tested the germination of spores placed on a membrane of thin rubber, perforated with holes comparable in size with stomata. This membrane was arranged with one side exposed to air saturated with water vapor and the other to the air of the laboratory. On the latter side spores of *Puccinia glumarum hordei* were sown, and after 2 days the membranes were microscopically examined and the germ-tubes were found entering the majority of these artificial stomata.

It is believed that other circumstances may possibly share in attracting the germ-tube to the stomata of the plant, but the attraction of the water vapor is believed to account for the first entrance of the germ-tube.

Smut in wheat, barley, and oats, and how to prevent it, I. B. P. EVANS (*Transvaal Agr. Jour., 4 (1906), No. 14, pp. 389–396, pl. 1*).—The author reports on the abundance of smut in wheat, barley, and oats in the Transvaal, and describes the copper sulphate, hot water, and formalin methods of treatment for its prevention.

Smut treatment, A. MACKAY (*Canada Expt. Farms Rpts. 1905, p. 364*).—Attention is called to the serious loss due to the presence of the bunt or stinking smut of wheat, and the author recommends the treatment of the seed wheat with solutions of formalin or copper sulphate before seeding. Formalin solutions are also recommended for the treatment of seed oats and barley.

Preventives of smut in wheat, S. A. BEDFORD (*Canada Expt. Farms Rpts. 1905, pp. 324, 325*).—According to the author, about 6 per cent of the wheat received at Winnipeg during the past year was rejected by the inspectors on account of the large amount of smut prevalent.

Attention is called to the desirability of treating seed, and the results of treating seed with formalin and copper sulphate are shown. In the experiments reported different lots of seed wheat were sprinkled and soaked with solutions of formalin and copper sulphate and the resulting crop was entirely free from smut, although the untreated wheat contained more than 12 per cent smutted heads. The increase in yield attributed to the treatment was from 2 to 5 bu. per acre on the different plats.

Notes on brusone, U. BRIZI (*Agr. Mod., 11 (1905), pp. 380, 394, 452; abs. in Centbl. Bakt.* [*etc.*], *2. Abt., 15 (1906), No. 21, pp. 653, 654*).—A study is given of brusone or smut of rice, in which the author reviews various theories regarding its cause and gives the results of his own investigations regarding it.

Voglino is said to have considered it primarily due to bacteria attacking the plants from the soil, while Ferraris and Farneti consider *Piricularia oryzæ* the cause of the disease. According to the author the injury to the plant is first shown on the finest rootlets, a fact which apparently escaped all previous investigators except Voglino (E. S. R., 15, p. 590).

The first indication of the disease may be seen in the browning of the parenchymatous tissues of the finest roots, followed by the discoloration of the epiblem and the central cylinder and later by the destruction of the protoplasm in the parenchyma cells. The appearance of the disease on the aerial parts of the plant follows after a considerable interval. If rice is grown in poorly aerated water cultures, typical brusone will develop on the roots, stems, and leaves within a few days, but the author takes this as an indication that the disease is not of parasitic origin, but that it results from the destruction of the roots in a poorly aerated soil. The disease is always worst in heavy soils accompanied with a high temperature.

For the prevention of the disease the author recommends the frequent changing of the water on the fields and deep stirring of the soil whenever possible.

While the disease is believed to be primarily due to constitutional causes, yet the uniform occurrence of organisms seems to indicate that it is greatly complicated by their activity.

On the stages of development reached by certain biologic forms of Erysiphe in cases of noninfection, E. S. SALMON (*New Phytol., 4 (1905), No. 9, pp. 217-222, pl. 1*).—Experiments were carried on with a number of biologic forms of *Erysiphe graminis*, and it was determined that the failure of the conidia to infect certain host species is to be attributed not to the failure of the germ-tube to penetrate the leaf cells of the plant, but to the inability of the fungus to develop the haustorium which is formed, or to the incapacity of the fully formed haustorium to adapt itself to the intracellular conditions.

A fungus disease of alfalfa in England, E. S. SALMON (*Gard. Chron., 3. ser., 39 (1906), No. 1000, pp. 122, 123; Jour. Bd. Agr. [London], 13 (1906), No. 1, pp. 51, 52*).—A report is given of diseased alfalfa plants which showed several superficial, warted, gall-like outgrowths, about $\frac{3}{4}$ in. across, found at the crown of the roots.

These galls, upon examination, proved to be due to attacks of *Urophlyctis alfalfæ*. From the appearance of the plants it was evident that they had been infested for some time, and some of the plants were almost dead. This is the first report of the fungus in England. It was first observed in Ecuador in 1892, and later reported as occurring in Germany (E. S. R., 14, p. 773). A detailed account of the disease and the results of investigations on the fungus are promised at some future time.

Potato scurf and potato scab, H. T. GÜSSOW (*Jour. Roy. Agr. Soc. England, 66 (1905), pp. 173-177, fig. 1*).—An account is given of a peculiar scabbed condition of potatoes which upon investigation was found to be due to *Rhizoctonia solani*. A comparison of descriptions of *R. violacea* and *R. solani* shows no morphological differences, and from the identity of the mycelium on alfalfa and on the potato there appears to be no doubt that these two species are identical. In this case *R. solani* must be considered as a synonym of *R. violacea*.

The author states that the scurf appearing on the potatoes does little injury to them either as an article of food or for use as seed, but when the disease progresses further so as to result in a scab-like form, while the food value of the potato is not affected, such tubers should in no case be used as seed. The so-called deep scab was found to be a stage of this disease, and tubers affected by this have little value as food and under no circumstances should be used as seed.

Bacterial wilt of tobacco, Y. UYEDA (*Bul. Imp. Cent. Agr. Expt. Sta. Japan, 1 (1905), No. 1, pp. 39-57, pls. 5*).—For 20 years or more there has been known in Japan a disease of tobacco variously designated as tobacco wilt, root rot, or black shank. The disease has been under the author's observation for about 5 years and has been determined to be of bacterial origin. In many ways it resembles the wilt of the eggplant and tomato, but the organisms are not identical.

The disease may attack the young as well as the full-grown plants any time from June to September. The affected plants wilt, the leaves become yellow, the stems are blackened, and the entire root system is destroyed. The bacteria gain entrance through the root hairs, stomata, and wounds, and inoculation experiments show that the disease can be readily transferred to sound plants, either by the transfer of the plant juices or by the use of pure cultures of the organism. In affected plants the bacteria are first noticed in the fibrovascular bundles of the stems and leaves, which soon become blackened. Later the darkening extends to the larger veins of the leaves and adjacent tissues.

The morphological and physiological characters of the organism are described at length and comparisons are drawn between the cause of this disease, which is given the name *Bacillus nicotianæ* n. sp., and a number of other bacteria which cause diseases of plants, especially *B. solanacearum*. The bacillus is found to attack many cultivated varieties of tobacco, although some have thus far escaped, as does *Nicotiana rustica*. Inoculation experiments have shown that positive results were obtained with pure cultures on *Physalis minimum*, *Capsicum longum*, *Polygonum tinctorium*, and *Amarantus gangeticus*, but failed with eggplants, tomatoes, and *Physalis alkekengi*.

Early planting and resistant varieties are the preventive means suggested. The author recommends in practice the burning of all trash and affected plants and care in the use of fertilizers, nitrogenous fertilizers tending to predispose the plants to the disease while potash fertilizers do not.

Tomatoes and their diseases, W. W. Froggatt (*Agr. Gaz. N. S. Wales, 17 (1906), No. 3, pp. 209–218, figs. 6*).—After a brief account of the culture of tomatoes, the author mentions some of their insect and fungus enemies. The insects mentioned are the bollworm (*Heliothis armiger*) and the Rutherglen bug (*Nysius vinitor*). Among the diseases described are the rosette of tomatoes, a curious malformation of young fruits to which the name "sheath calyx" is given; sleepy disease, due to *Fusarium lycopersici;* black rot, caused by *Macrosporium tomato;* pimply rot; leaf rust, due to *Cladosporium fulvum*, and leaf blight, caused by *Septoria lycopersicæ*. Where known, methods of treatment for the prevention of these diseases are given.

The parasitism of Neocosmospora, H. S. Reed (*Science, n. ser., 23 (1906), No. 593, pp. 751, 752*).—The author reports having found in ginseng gardens in Missouri in 1904 a wilt disease which is attributed to *Neocosmospora vasinfecta* var. *nivea*. The fungus has been studied and described in a bulletin of the Missouri Experiment Station (E. S. R., 17, p. 1164), and in the present article the author calls attention to some features in the parasitism of the fungus.

The fungus is generally believed to be an active parasite, but the results of the author's studies seem to confirm the claim of Atkinson (E. S. R., 4, p. 831) that it is a weak parasite and only attacks plants which are first weakened by the presence of some other fungus. This conclusion is based on the facts that the wilt disease did not appear except on ginseng plants previously attacked by anthracnose, that spraying the plants for the prevention of anthracnose was followed by freedom from wilt, and that watermelons grown in sterilized soils that received test-tube cultures of the organism failed to show the slightest indication of the wilt disease. The author believes that in previous investigations where active parasitism of Neocosmospora was claimed the soil was not sterilized, and that, so far as his experiments go, the form isolated from the ginseng plant is not an active parasite.

Some fungus diseases and their treatment, B. F. Floyd (*Missouri Sta. Circ. Inform. 21, pp. 12*).—Brief descriptions are given of a number of fungus diseases of various fruits, berries, vegetables, and ornamental plants, and, so far as known, suggestions are given for their treatment.

Pear blight work and its control in California, M. B. Waite and R. E. Smith (*Cal. Fruit Grower, 33 (1906), No. 923, pp. 1, 3–6, 9, 12–15, figs. 2*).—A review is given of the work carried on in the State.

Investigations on grape anthracnose, P. Viala and P. Pacottet (*Rev. Vit., 24 (1905), Nos. 618, pp. 433–439, figs. 7; 620, pp. 489–496, figs. 15; 621, pp. 517–523, figs. 3; 623, pp. 573–580, figs. 13; 624, pp. 601–608, figs. 5; 626, pp. 657–663, pls. 6, figs 8; 25 (1906), Nos. 632, pp. 89–91, figs. 4; 641, pp. 341–347, figs. 14; 642, pp. 369–375, figs. 17*).—The results of studies on the fungus *Man-*

ginia ampelina or *Sphaceloma ampelinum*, the cause of the grape anthracnose, are given.

The various forms of reproduction are figured and described, especial attention being given to the morphology and biology of the organism. Attention is called to the fact that the disease can not be controlled by a single winter treatment of the vines with a strong solution of iron sulphate, as it does not fully penetrate the sclerotia. Two applications at intervals of 15 days will be found more efficient, but even this treatment will not wholly prevent the disease.

Notes are also given on the anthracnose of peas and of plane trees due, respectively, to *Glœosporium nervisequum* and *G. lindemuthianum* or, as it is more frequently called, *Colletotrichum lindemuthianum*. By the same methods of study as those pursued in the investigations of the grape anthracnose, the authors found the same kinds of organs of reproduction, namely, spermagonia, pycnidia, cysts, yeast-like bodies, conidia, etc., and their development differed only in individual particulars.

Hints on the treatment of grape mildew, L. Degrully (*Prog. Agr. et Vit. (Ed. l'Est), 27 (1906), No. 15, pp. 429–433*).—Attention is called to the advisability of early and thorough spraying for the prevention of the downy mildew of grapes, and formulas are given for the preparation of different fungicides, together with directions for their application.

Report on experiments for the control of mildew in 1905, E. Chuard, H. Faes, and F. Porchet (*Chron. Agr. Vaud., 19 (1906), Nos. 6, pp. 145–153; 7, pp. 181–189; 8, pp. 226–235; and 9, pp. 270–274*).—An account is given of some cooperative experiments on the control of grape mildew by the use of fungicides. This work was begun in 1903 and continued in 1904 and 1905, and the present report is based very largely upon the results obtained in 1905.

In the investigations it was found that the mildew made its appearance earlier than usually reported, on which account the first application of the fungicide should be advanced beyond the date generally recommended, namely, June 15. In the vineyards treated 6 reported perfectly satisfactory results; in 3 others the results were less satisfactory, but an analysis of the reports indicates that the treatment was not strictly in accordance with the recommendations given.

All the reports show that the fungicides which were used, consisting of Bordeaux mixture, soda Bordeaux, and copper acetate solutions, need not be used in strengths greater than 2 per cent, these being as efficient as those used in greater concentration. For the first application not less than 600 liters per hectare should be employed, to be followed by 3 or 4 applications at the rate of 1,100 to 1,200 liters per hectare. The time intervening between the applications should not exceed 20 days during years favorable for the development of the fungus.

Smut of cultivated bamboo, S. Hori (*Bul. Imp. Cent. Agr. Expt. Sta. Japan, 1 (1905), No. 1, pp. 73–89, pls. 4*).—The author notes having received in 1904 specimens of the large bamboo (*Phyllostachys puberula*) that were affected with a smut. The disease always occurs on the younger internodes and growing portions of the branches, and apparently it may appear whenever the surrounding conditions are favorable, from the time the spring buds open until the growth of the branches ceases. Such diseased branches seem generally to stop further growth, and finally the entire plant is destroyed.

The smut has been found on several kinds of bamboo, both cultivated and wild, but where the large bamboo is extensively cultivated it seems to be confined to that species. At present it is known to occur on 4 species, namely, *Phyllostachys bambusoides*, *P. puberula*, *Sasa ramosa*, and *Arundinaria simoni chino*.

The characters of the fungus are described at considerable length, and as a result of the author's studies he determines it as probably identical with *Ustilago shiraiana*, an amended description of which is given.

As preventive measures it is recommended that smutted branches be cut off and burned before the spore masses mature and the spores are scattered, and the removal of wild species in regions where the large bamboo is extensively cultivated. It is believed that spraying with Bordeaux mixture at the time the spring buds are developing would prove beneficial.

The wilt disease of pigeon pea and pepper, E. J. Butler (*Agr. Jour. India, 1 (1906), No. 1, pp. 25–36, pls. 5*).—A description is given of wilt diseases of the pigeon pea (*Cajanus indicus*) and of the cultivated black pepper.

The pigeon pea wilt is found over a wide extent of India and in some regions is of serious consequence. The plants are attacked here and there over the field, and when a period of hot dry weather occurs large areas appear suddenly infected. The practice in growing this crop in India is to ratoon the fields, and in these the fungus spreads so that in some instances all plants are killed.

An examination of the diseased plants showed the presence of a fungus which the author has determined as a species of Nectria, and inoculation experiments have shown in a considerable proportion of the trials that the disease is due to some of the stages of this organism, 3 of which are described at some length.

In the account regarding the pepper vine wilt, the author states that the serious destruction of the plants in some regions threatens the industry. In many instances it was found that the wilted plants were affected by nematodes (*Heterodera radicicola*), but the uniformity of the symptoms of the disease seemed to indicate that some other cause than the nematodes must be ascribed to it, and evidence is presented which the author believes warrants the statement that it is due to a species of Nectria. The symptoms of the disease are described, and it appears that while the nematodes may contribute to the destruction, the primary cause is to be attributed to the fungus.

In conclusion the author enumerates a number of species of plants that are subject to wilt diseases, about 1 dozen cultivated crops being more or less subject to damage from this cause.

Tree root rot (*Jour. Bd. Agr. [London], 13 (1906), No. 2, pp. 111–114, fig. 1*).—A root rot of trees, due to *Armillaria mellea* or *Agaricus melleus*, is described, and it is stated that nearly all kinds of orchard and deciduous trees are subject to its attack as well as many coniferous trees.

Usually the first indication of disease is to be observed in the drooping and yellowing of the foliage, and when these symptoms appear the presence of a thin firm white sheet of mycelium situated between the bark and the wood about the collar of the plant or on the main root branches indicates that this fungus is the cause of the trouble. Later this mycelium extends up the trunk of the tree and changes into black cord-like strands of mycelium, known as rhizomorphs.

When trees are found affected a portion of the bark at the collar should be removed and if the mycelium is found to have grown up the trunk the best course to be recommended is to cut down the tree, removing as much as possible of the root, which should be burned. If the mycelium has not ascended the trunk but is confined to certain branches of the root they should be removed and as much as possible of the root exposed and covered with a mixture of lime and sulphur. When the toadstool forms appear at the base of the trunk they should be collected and burned.

A canker of the yellow birch, J. B. Pollock (*Rpt. Mich. Acad. Sci., 7 (1905), pp. 55, 56*).—A brief description is given of a canker observed on branches and

twigs of yellow birch. This canker not only causes the disfiguration of the tree, but seriously interferes with its growth by cutting off the channels of water and reserve transportation.

An examination showed that the canker was due to a species of Nectria which agrees fairly well with *Nectria coccinea*, although differing from the descriptions usually given. A modified technical description of the fungus is presented, and while there is no experimental proof of its parasitism, it is concluded that the canker of the yellow birch is due to this fungus. The disease is local in its attack, not spreading from a given point of infection but through new inoculations. The point of infection is usually the base of a dead lateral twig, and the cause is probably due to a wound parasite.

The Novar system of combating larch disease (*Jour. Bd. Agr.* [*London*], *12* (*1906*), *No. 12, pp. 722–725*).—On account of the serious injury caused by the larch disease in areas where larch is grown as a pure crop, a number of methods have been suggested for reducing the liability to serious loss.

A method, known as the Novar system, suggested by Mr. Munro Ferguson, is described which reduces the liability to loss very considerably. This consists of planting pure larch woods, and when the trees attain an age of 16 to 20 years all are removed except the soundest, of which from 300 to 500 per acre are left. Stems that are sound or fairly sound at this age are not likely to suffer from disease later in life.

In order to keep the surface of the ground clear of grass and similar vegetation, additional trees are provided, and for this purpose it is suggested that Norway spruce, silver fir, or beech be planted underneath the fir, all these species being tolerant to shade. Other species have been experimented with and the list can probably be considerably extended. In about 20 years from the first thinning the larches will be thinned again so as to have a stand of 100 to 200 trees per acre, which will be ready for market at from 60 to 80 years.

Notes on the variation and possible parasitism of Ganoderma sessile, J. B. Pollock (*Rpt. Mich. Acad. Sci., 7* (*1905*), *pp. 53, 54*).—A brief account is given of the occurrence of specimens of this fungus, which were found on a maple tree in the University of Michigan campus, and in addition has been reported on oak trees from other localities.

The author notes some variations from the original description, and shows that it has stipitate as well as sessile forms. In considering the effect upon the host it is believed to be a wound parasite which destroys the bark and cambium of the tree but does not attack the living wood.

Bud rot of carnations, F. D. Heald (*Abs. in Science, n. ser., 23* (*1906*), *No. 590, p. 620*).—A troublesome bud rot of carnations due to a species of Fusarium is described. The rotting buds always contained a mite in addition to the fungus.

Pure cultures were made of the fungus, and successful inoculations were carried out. The fungus was again isolated and new inoculations made which indicated that the fungus alone was capable of producing the rotting. The experiment with inoculations of the mite into the buds did not produce the disease. It was suggested that the mites act only as carriers of the fungus and intensify its severity. The Lawson carnation was noticed as the most susceptible variety.

A disease of narcissus, F. J. Chittenden (*Gard. Chron., 3. ser., 39* (*1906*), *No. 1010, p. 277, fig. 1*).—The author reports the occurrence in a field of *Narcissus poeticus* of a disease which does not appear to have been noticed heretofore. Both leaves and flower stalks were affected, but the bulbs appeared not to suffer except in so far as they were injured by interference with the functions of the leaf.

The disease is characterized by the presence of yellowish-brown spots on the leaves and flower stalks, the spots sometimes appearing at the tips of the leaves, but usually some distance below. The disease usually makes its first appearance about the end of April, and where the cells are killed the upper part of the leaf stalk or flower stalk frequently bends over. When the flower stalk is attacked the flowers naturally suffer, sometimes failing to open entirely, and they are always injured for market purposes on account of the reduction in the length of the stalk.

The fungus, which appears to be hitherto undescribed, is a species of Ramularia, to which the name *R. narcissi* is given. A technical description is appended.

The best means of preventing the disease thus far known seems to be a solution of one-half ounce of potassium sulphid in a gallon of water.

A species of Hormodendron on Araucaria, J. B. Pollock (*Rpt. Mich. Acad. Sci., 7 (1905), pp. 56, 57*).—The writer's attention was recently called to an olive-colored mold-like growth on the surface of living branches and leaves of an Araucaria grown as a house plant. The growth while not copious was easily visible by the fact that the parts coated by the fungus were of a noticeably different color from the normal parts. An examination showed that the fungus was a species of Hormodendron, probably *H. cladosporioides*. Later the same fungus was found in a greenhouse at Ann Arbor growing on diseased violet leaves.

The only species of Hormodendron that has been described as an active parasite is *H. hordei*, which is quite destructive to barley. The question is raised as to whether the fungus on the Araucaria is parasitic or not, and it is believed that the condition under which the plant was grown indicates that if parasitic the fungus is only weakly so.

Directions for making Bordeaux powder, R. M. Bird (*Missouri Sta. Circ. Inform. 20, pp. 3*).—As the result of experience in the use of dry Bordeaux mixture powder in orchards, a modification of the directions for making the mixture previously given (E. S. R., 15, p. 166) is noted, whereby the work is simplified and much of the annoyance of flying dust and lime is avoided.

As now recommended, 10 lbs. of copper sulphate is dissolved in 4 gal. of hot water. From a barrel of quicklime 5 lbs. of the best is taken to make a milk-of-lime solution with 4 gal. of water. The remaining lime is slacked to a perfectly dry dust. The copper and milk-of-lime solution are poured together simultaneously into a third vessel and stirred until no greenish streaks appear, after which the mixture, water and all, is scattered in the lime dust and mixed with a rake. While still somewhat damp it is rubbed through the sieve and spread out to dry. This requires a day or two, after which the mixture will keep indefinitely. These quantities make about 250 lbs. of powder.

Bordeaux mixture, G. Gándara (*Com. Par. Agr. [Mexico], Circ. 35, pp. 9, figs. 11*).—Directions are given for the preparation and application of Bordeaux mixture for the control of various fungus diseases.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Directions for destroying pocket gophers, D. E. Lantz (*U. S. Dept. Agr., Biol. Survey Circ. 52, pp. 4, figs. 3*).—Pocket gophers are distributed almost everywhere west of the Mississippi and are occasionally so injurious that they must be combated by means of strychnin, carbon bisulphid, or traps. The present circular is based on Bulletin 5 of the Biological Survey (E. S. R., 7, p. 20).

Directions for preparing specimens of large mammals in the field, C. H. Merriam (*U. S. Dept. Agr., Biol. Survey Circ. 49, pp. 4, figs. 6*).—For the pur-

pose of assisting field agents and others in preparing satisfactory skins for shipment to the Bureau, directions are given regarding measuring, skinning, drying, and otherwise preserving the skins of mammals of all sizes. Suggestions are also made regarding labeling, packing, and shipping of such specimens.

Importation of snakes into Hawaii, J. WILSON (*U. S. Dept. Agr., Biol. Survey Circ. 48, p. 1*).—Notice is given that on and after August 1, 1905, no permits shall be issued for the introduction of snakes of any kind into any part of the Hawaiian Islands.

Directory of State officials and organizations concerned with the protection of birds and game, 1905, T. S. PALMER (*U. S. Dept. Agr., Biol. Survey Circ. 50, pp. 16*).—This directory, which has been published since 1900, has been revised in the present issue to August 15, 1905. In summarizing the contents of the circular it is shown that in 36 States the enforcement of the game laws is entrusted to State officers, in 6 States to county officers, and in Virginia to city or district wardens.

List of publications of the Biological Survey, Department of Agriculture (*U. S. Dept. Agr., Biol. Survey Circ. 51, pp. 6*).—A list is given of the bulletins, North American fauna, circulars, farmers' bulletins, and reprints of Yearbook articles furnished by the members of the Bureau.

The monthly bulletin of the division of zoology, H. A. SURFACE (*Penn. Dept. Agr., Mo. Bul. Div. Zool., 3 (1906), No. 10, pp. 303–332, pls. 4*).—The life history, food plants, distribution, and injurious attacks of the San José scale are outlined and notes are given on the inspection service and treatment undertaken for the purpose of suppressing this pest. A lime-sulphur-salt wash is used according to the formula 22-17-10-50, boiled by the aid of artificial heat. The author recommends boiling for 1 hour. Notes are also given on the self-boiled lime-sulphur-soda wash, whale-oil soap, oil emulsions, and other remedies.

Twentieth report of the State entomologist on injurious and other insects of the State of New York, 1904, E. P. FELT (*N. Y. State Mus. Bul. 97, pp. 359–597, pls. 19, figs. 24*).—During the year under report an unusually small amount of injury to agricultural crops was caused by insect pests.

An investigation was made of methods for combating the grape rootworm. It was found that this insect deposits 45 per cent of its eggs within the first 2 weeks of the period of egg laying and 73 per cent during the month of July. The most successful means of combating this insect was found in beetle catchers, which have proved very satisfactory throughout the extensive tests of the past 3 years. On an experimental area of 5 acres over 150,000 beetles were captured in this manner, the number of the pest being reduced about 98 per cent.

Further experiments were made with arsenical poisons, but the results obtained from this method are difficult of estimation on account of the great activity of the beetles. Apparently about 50 to 60 per cent of the beetles may be destroyed by keeping the grapevines covered with an arsenical solution. Some of the pupæ may be destroyed by a thorough cultivation. It is therefore recommended that a ridge of earth be thrown upon the base of the vines in the fall or early spring and removed during the first half of June.

A long series of tests was made with various forms of lime-sulphur wash in combating the San José scale. In preliminary laboratory experiments ordinary washing soda appeared to give much better success in obtaining a combination of lime and sulphur than when caustic soda was employed. Washing soda has the advantage over caustic soda that it may be purchased almost anywhere and requires no special care in handling. A great variety of formulas were tested in the preparation of lime-sulphur wash with or without caustic soda or washing soda.

In these experiments it was found that all of the lime-sulphur combinations were almost equally effective. It appears to be possible, therefore, to allow a relatively wide range in the proportions of the ingredients of this wash. In general, however, the author prefers a formula calling for 20 lbs. lime and 15 lbs. sulphur per 50 gal. water with a boiling period of at least 30 minutes. The 2 other formulas especially recommended contain the same amount of lime and sulphur and 4 to 6 lbs. caustic soda or 10 lbs. washing soda.

Brief notes are given on various insects which caused more or less damage during the year. These include fruit-tree bark-beetle, apple-leaf miners, tussock moth, fall webworm, violet sawfly, buffalo tree hopper, pea louse, larder beetle, etc. Another attempt to establish *Chilocorus similis* appeared to be unsuccessful. The voluntary entomological service of the State is briefly described and a list of publications by the entomologist is presented together with a catalogue of contributions to the collection of insects.

Considerable attention was given to mosquitoes. A table is presented for the identification of mosquito larvæ, several new species are described, and notes are given on their life history. Notes are also given on the life history, habits, and distribution of the gypsy moth and the brown-tail moth.

H. Osborn made a study of the Jassidæ of New York State, and presents a discussion of these insects based on a list of 175 species found in the State (pp. 498–545). A list of Lepidoptera taken at Keene Valley, New York, is presented by G. F. Comstock.

Report of the entomologist, J. FLETCHER (*Canada Expt. Farms Rpts. 1905, pp. 159–200, pl. 1*).—During the year under report the Hessian fly was not particularly injurious. Some observations were made on the insect parasites of this pest. In Manitoba and the Northwest Territories the western wheat-stem sawfly caused some injury, and complaints were also made regarding joint worm, wheat midge, and cutworms in cereals. The method of using poisoned bran in the control of these pests is very satisfactory. It is stated that the Criddle mixture still proves effective when used against locusts. Notes are also given on bee moth, rose chafer, stalk borer, bollworm, variegated cutworm, carrot rustfly, cucumber beetle, sugar-beet webworm, San José scale, codling moth, woolly aphis, apple maggot, strawberry weevil, *Otiorrhynchus ovatus*, larch sawfly, spruce gall louse, Tussock moth, *Therina somniaria*, etc.

A report of the work of the apiary for the season of 1905 was made by J. Fixter (pp. 194–200). Successful attempts were made to prevent swarming by offering more room for brood comb and honey production. Attention is called to the desirability of keeping a close watch on the annual production of each colony of bees in order to improve the productiveness of the whole apiary. It is believed that in this way the amount of honey production may be considerably increased. The use of queen cells in small nuclei is explained as a system of queen rearing. In the case of infestation of combs by the bee moth, these pests may be destroyed by a fumigation with sulphur.

On some injurious insects in 1905, R. S. MACDOUGALL (*Trans. Highland and Agr. Soc. Scot., 5. ser., 18 (1906), pp. 224–237, figs. 23*).—Notes are given on a number of insects injurious to garden crops and forest trees. These pests include *Centhorhynchus sulcicollis*, *C. assimilis*, and *C. contractus* attacking cabbage and turnip, pea and bean weevils, carrot fly, turnip flea-beetle, grain weevil, diamond-back moth, crane flies, pine weevils, pine sawfly, goat moth, etc.

The remedy recommended for the cabbage and turnip weevils consists in soaking the seed for 4 hours in turpentine or kerosene. The carrot fly may be largely controlled by spraying with kerosene emulsion after sowing, again after germination, and a third time after thinning the carrots.

Some insects injurious to forests. The locust borer, A. D. Hopkins (*U. S. Dept. Agr., Bur. Ent. Bul. 58, pt. 1, pp. 16, pl. 1, figs. 6*).—Attention is called to the unusually serious depredations by this insect upon the black locust. In some localities the damage has been so great as to be unprofitable to grow the tree for shade or timber. The author considers it unadvisable, however, to abandon all attempts to cultivate the locust on account of the presence of the borer.

Detailed notes are given on the habits and life history of this species and on its distribution. With regard to the control of the locust borer the author suggests that infested trees be cut between the first of May and middle of September and utilized in such a way as to destroy the immature forms of the insect in the bark and wood. It may be possible to find localities in which the borer is not particularly injurious. The insects may also be readily collected from the flowers of golden-rod. Experiments will be conducted to determine whether a resistant race of black locust trees can be propagated. A bibliography of the articles relating to this insect is also given.

The principal insects injurious to the cocoanut palm, C. S. Banks (*Philippine Jour. Sci., 1 (1906), No. 2, pp. 143–167, pls. 11*).—*Oryctes rhinoceros* is most frequently found in heaps of decaying vegetation. The larvæ attack the soft-growing point of the cocoanut. This pest is described in its various stages. The injurious attack of the insect proceeds from above downward. The adult beetle makes burrows for egg laying and for securing food, and nearly all cocoanut trees in the Philippines are eaten somewhat by this pest. Direct remedies are very difficult to apply, but considerable benefit may be derived from cleaning away all weeds, underbrush, and other rubbish underneath the cocoanut trees. Notes are also given on the habits, life history, and injurious attacks of *Rhynchophorus ferrugineus* and other insects which attack the wood of the cocoanut.

The corn root louse, J. J. Davis (*Ill. Agr., 10 (1906), No. 7, pp. 213–218, figs. 6*).—The economic importance and distribution of this pest are briefly described and notes are given on the amount of damage which it may cause if left without any treatment. The pest is cared for by the common brown ant. Notes are given on the success which has recently been had by the Illinois Experiment Station in combating this pest by thorough cultivation of the soil before planting and late in the fall.

The cotton worm, R. S. Woglum (*N. C. Dept. Agr. Ent. Circ. 16, pp. 8*).—The habits, life history, and means of combating this pest are briefly described. As artificial remedies, dusting with Paris green mixed with flour or air-slaked lime, and spraying with Paris green and lime in water are recommended.

Experiments to control the pea worm, N. S. Blair (*Canada Expt. Farms Rpts. 1905, pp. 311, 312*).—Pea vines were sprayed with Paris green at the rate of ¼ lb. to 40 gal. of water to which a little whale-oil soap was added to make the mixture adhere more thoroughly. In some cases the amount of Paris green was doubled. It appears that the early varieties of peas are much less subject to injury from the pea worm than the later varieties. Spraying with Paris green just as the pods are beginning to form appears to be not so effective as when the operation is done a little later.

Combating the grain weevil, M. Albrecht (*Wchnschr. Tierheilk. u. Viehzucht, 49 (1905), No. 52, pp. 826, 827*).—On account of the great destruction which this insect causes to corn and other cereal grain, a number of remedies have been suggested for controlling it. According to the author, if dry sand be mixed with grain infested with the weevil, the insects will crawl out of the grain as soon as possible and will not penetrate back into the sand. They may therefore be easily destroyed on the surface of the sand.

On a crane fly (Tipula parva), S. Onuki (*Bul. Imp. Cent. Agr. Expt. Sta. Japan, 1 (1905), No. 1, pp. 90–94, pl. 1*).—The larvæ of a supposed crane fly temporarily referred by the author to *Tipula parva* is widely distributed in Japan and is one of the worst pests of rice in that country. In some localities from 60 to 90 per cent of the seedlings are destroyed. There are two annual generations of the insect. The pest is described in its various stages. It appears that the larvæ can not exist in water for a long time and flooding for 6 to 36 hours is therefore the easiest, cheapest, and most effective method of controlling the insect.

Ravages of the gypsy and brown-tail moths (*Medford, Mass.: Medford Mercury, 1906, 2. ed., pp. 10, pls. 122*).—This volume contains a brief account of the present distribution of the gypsy and brown-tail moths, with notes on the injury caused by these pests and a copy of the act of the Massachusetts legislature, approved May 5, 1905, providing for the suppression of the gypsy and brown-tail moths. The major portion of the volume is occupied with a series of reproductions of photographs showing the prevalence of the gypsy and brown-tail moths in various parts of the infested district and the damage done by these pests to trees.

Spraying apples for the plum curculio, S. A. Forbes (*Illinois Sta. Bul. 108, pp. 268–286, figs. 4*).—The author first began his work on methods of controlling the plum curculio on apples in 1885.

Elaborate experiments were carried out in 1904, using arsenate of lead as an insecticide. Different sets of trees were sprayed from 6 to 8 times, at intervals of about 10 days, between May 6 and July 28. The apples obtained from sprayed and unsprayed trees were collected, counted, and notes made on their condition. It appeared that the yield of the orchard was increased by about one-half as the result of spraying, while the size of the fruit was increased about one-fifth, thus making the value of the apple crop 2 to 3 times as great as it would be without the spraying.

The cost of spraying was 17 cts. per tree for four applications; the work costing 15 cts. and material 2 cts. Since arsenate of lead adheres quite firmly to the skin of the apple a chemical analysis was made to determine whether apples sprayed with this insecticide would be injurious as food. According to this analysis one grain of arsenic was found adhering to four pounds of apple peelings, when the fruit was removed, one day after being sprayed with four times the usual strength of the insecticide.

The author also discusses the influence of sprayed and unsprayed blocks of trees upon one another, particularly with reference to the conclusions to be drawn from spraying experiments.

Spraying apples for the plum curculio, S. A. Forbes (*Illinois Sta. Bul. 108, abs., pp. 3*).—A brief summary of Bulletin 108, noted above.

Comparative experiments with various insecticides for the San José scale, S. A. Forbes (*Illinois Sta. Bul. 107, pp. 241–261*).—In control work in orchards infested with San José scale the author tested 11 insecticide mixtures, with particular reference to their effectiveness and cost.

The results obtained in these experiments indicate that mixtures of lime and sulphur, without any other ingredient, are cheapest and most efficient. In the experiments in question these mixtures cost from \$0.84 to \$1.03 per 100 gal., while the California wash, containing salt, cost from \$0.94 to \$1.07 per 100 gal.; Oregon wash about the same, and self-boiled mixtures of lime and sulphur cost considerably more. Some of the commercial insecticides, containing the same ingredients, cost as much as \$5 per 100 gal.

In general the early spring appeared to be the best time for treating trees for scale insects, while the midwinter treatments were far less effective. Proprie-

tary soluble oil mixtures are easily applied, but are somewhat less efficient than lime and sulphur and cost about $2\frac{1}{2}$ times as much. Whale-oil soap was also found to be efficient, but cost nearly 8 times as much as lime and sulphur.

Comparative experiments with various insecticides for the San José scale, S. A. FORBES (*Illinois Sta. Bul. 107, abs., pp. 3*).—A brief summary of bulletin 107, noted above.

The cottony maple scale, S. A. JOHNSON (*Colorado Sta. Bul. 116, pp. 16, figs. 4*).—Brief notes are given on the distribution, food plants, life history, natural enemies, and treatment for this pest.

Attention is called to the fact that the insect is ordinarily not as injurious in natural forests of maples as upon maple trees planted for shade purposes on lawns and along highways. Experiments were made with kerosene emulsion, varying in strength from 5 to 50 per cent, with whale-oil soap, and with a proprietary insecticide. It appears from these tests that the cottony maple scale may be controlled by application in winter of kerosene emulsion at a strength of 15 per cent or greater, or by the use of whale-oil soap at the rate of 1 lb. to 1 gal. of water. Under unfavorable conditions it may be necessary to use a slightly greater strength of the insecticides.

The winged form of phylloxera, H. FAES (*Chron. Agr. Vaud, 18 (1905), No. 23, pp. 580, 581*).—Experiments were undertaken to determine the conditions under which the winged form of this insect appears. When underground forms were collected in warm weather and kept under close observation, winged forms appeared within 5 days. In cold weather the winged forms did not appear at all.

The farmer's garden and its enemies, W. W. FROGGATT (*Agr. Gaz. N. S. Wales, 16 (1905), No. 10, pp. 1034–1040, pl. 1, figs. 6*).—According to the author too little attention is paid to the insect pests of garden crops. Notes are given on the appearance, habits, and means of combating snails, slugs, centipedes, bollworm, cabbage aphis, potato moth, diamond-back cabbage moth, *Plusia verticillata*, *Nysius vinitor*, *Aulacophora hilaris*, etc.

Fifty years' progress in the practical control of insect and fungus pests of Illinois horticulture, S. A. FORBES (*Trans. Ill. Hort. Soc., n. ser., 39 (1905), pp. 219–227*).—Brief historical notes are given on the work of investigators regarding insect and fungus pests in Illinois with special reference to the developments which have been accomplished in insecticides and fungicides.

The control of insects, fungi, and other pests, G. M. BENTLEY (*Tennessee Sta. Bul., Vol. XVIII, No. 4, pp. 31–45, figs. 4*).—Suggestions are made regarding the preparation of the standard insecticides and fungicides and their application in the control of the more important insect pests and fungus diseases.

Insects and insecticides, C. P. GILLETTE (*Colorado Sta. Bul. 114, pp. 46, figs. 33*).—This bulletin is essentially a revision of Bulletin 71 of the station, with additional notes on the insect pests of currants and gooseberries (E. S. R., 14, p. 169).

The fumigation of nursery stock, A. F. BURGESS (*Ohio Dept. Agr., Div. Nursery and Orchard Insp. Bul. 6, pp. 18, pls. 7*).—During the fall of 1904 a series of experiments was made to test the effect of fumigation upon nursery stock. For this purpose peach, plum, apple, pear, cherry, and privet trees were used. The time of exposure varied from 40 minutes to 5 hours and the amount of cyanid from $\frac{1}{2}$ to 3 oz. per 100 cu. ft.

From these experiments it appears that fumigation is the best known method for treating nursery stock. It destroys all living insects with the exception of the larvæ of borers. It is less effective on the eggs of oyster-shell bark-louse or scurfy scale. Nursery trees and shrubs may be injured if treated with excessive strengths of gas, but no injury was caused by the use of 1 oz. of cyanid per 100 cu. ft. for an exposure of 40 minutes.

In general it is believed that nursery stock is more injured by the treatment before and after fumigation than by the process of fumigation. In order to obtain successful results it is necessary that the fumigating house be gas tight and that the chemicals be of high grade. Fumigation of orchard trees in Ohio is considered impracticable.

Spraying fruit trees, A. DICKENS and R. E. EASTMAN (*Industrialist, 32 (1906), No. 28, pp. 435–444, figs. 4*).—During recent years it is said that the quality of fruit produced in Kansas has somewhat deteriorated on account of lack of attention to the necessity of spraying. The general importance of spraying is briefly referred to and notes are given on methods of controlling codling moth and other insects, together with an account of some of the most effective insecticides, such as arsenate of lead and a combination of Bordeaux mixture and Paris green.

Petroleum emulsions, C. L. PENNY (*Delaware Sta. Bul. 75, pp. 39*).—On account of the importance of soluble oils in spraying for various scale insects, the author made a study of various methods by which such combinations can be brought about.

It appears that a potash soap can be dissolved in kerosene more readily than a soda soap. Soaps are most efficient as emulsifiers when they are made from neatsfoot or sweet oil, while those made from cotton-seed oil, lard or castor oil are poorly adapted to the purpose. Commercial oleic acid and fish oil seem to be particularly excellent emulsifiers. Various combinations may be used in producing soluble oils. It is not necessary to use soap alone, but carbolic acid, ammonia, alcohol, or even water may assist. If soap with or without other materials is capable of emulsifying 25 times its weight of kerosene oil the ratio is said to be a high one. The author found it possible to prepare an emulsifier which would produce a satisfactory emulsion when mixed with 40 to 100 times its weight of kerosene.

It is found that if emulsions are made without any free oil they may then be diluted with water indefinitely without danger of separation into component parts. In general it is desirable to obtain a mixture with a high ratio or one in which the amount of oil is very large as compared with the soap. It appears that if a little water is added to the soap before mixing with the full amount of kerosene the emulsion is made much more easily.

After preparing soluble oils by means of an emulsifier and kerosene or petroleum it may seem desirable in some cases to add some other insecticide to the mixture. Most of these substances, however, are incompatible with soluble oils and cause them to decompose. Paris green is about the only exception.

A number of detailed formulas are given for the preparation of the petroleum emulsions. The various formulas are given for the purpose of showing how emulsions can be made but without recommendations of their efficiency in destroying insects since they have not been thoroughly tested by the station.

Chemistry of insecticides and fungicides, F. T. SHUTT (*Canada Expt. Farms Rpts. 1905, pp. 149–154*).—The soda-Bordeaux or Burgundy mixture was prepared according to 2 formulas calling for 4 to 6 lbs. of copper sulphate and 5 to 7½ lbs. of carbonate of soda per 40 gal. of water.

This mixture has been used chiefly for potatoes. It was tested on orchard trees with the result that it proved harmless to the foliage except when Paris green was used in connection with it. Brief mention is also made of the use of limoid in the preparation of kerosene emulsion and of flour also used for this purpose. It is found possible to make a valuable emulsion with kerosene by adding flour at the rate of 8 oz. to 1 qt. and water added at the rate of 2 gal. for every quart of kerosene. After thorough churning the mixture is then ready for use. The flour emulsion spreads readily and does not clog the nozzle.

Notes are also given on formalin and milky formaldehyde as a smut preventive and potassium cyanid for fumigation purposes.

A chemical study of the lime and sulphur dip, R. H. SHAW (*Trans. Kans. Acad. Sci., 20 (1905), pt. 1, pp. 53–60*).—Some time has been spent by the author in investigating the chemical composition of lime and sulphur dips.

In order to study the composition of this dip and the changes which it undergoes, small vats were constructed in the laboratory so as to provide condiitons as nearly as possible like those which prevail in actual field work. During the first day the ratio of calcium in thiosulphate to the calcium in the sulphids was as 1 : 8, while on the sixteenth day it was 5 : 8. Likewise on the first day the ratio of the sulphur in the thiosulphate to the sulphur in the sulphids was as 1 : 13, while on the sixteenth day it was 4 : 13. The specific gravity was also found to increase constantly and regularly. This is due to concentration from the evaporation of water and also to the oxidation of sulphids.

On certain tropical ants introduced into the United States, W. M. WHEELER (*Ent. News, 17 (1906), No. 1, pp. 23–26*).—*Monomorium destructor* was reported from Florida and Alabama. This ant is believed to have been recently introduced from the Tropics. It feeds on either vegetable or animal substances. Two other tropical ants have recently appeared in the United States, *Iridomyrmex humilis* and *Prenolepis longicornis.*

The deposition of eggs and the larval life of Tabanidæ, A. LÉCAILLON (*Ann. Soc. Ent. France, 74 (1905), No. 1–2, pp. 20–28, pl. 1, fig. 1*).—A brief review is given of the literature relating to this subject.

The author's observations were confined largely to *Tabanus quadrinotatus.* The female of this species lays its eggs on the stems of various plants at a short distance above the ground. The eggs are deposited in large masses attached to these plants and the female appears to select sometimes a moist and sometimes a comparatively dry locality for oviposition. The larvæ hatch within 13 days or occasionally a longer period and live in the soil, feeding on animal or vegetable material.

According to the author's observations the larvæ did not attack other insect larvæ placed conveniently for them, but would suck out the juices of such insects after they had been killed.

The eradication of warble flies by the cooperation of dairy associations, N. VILLEMOES (*Ztschr. Fleisch u. Milchhyg., 16 (1906), No. 7, pp. 226–228*).—The first attempts along this line were without much result for the reason that sufficient interest was not felt in the matter by the individual dairyman. In subsequent years, however, the work of eradicating warble flies was prosecuted more industriously and with better success. In 1905 a total of 4,333 cows were treated at a cost of 58¾ days' work, and the number of warble-fly larvæ destroyed was 10,396. The results shown in the greater comfort of the cows and larger yield of milk indicate that the treatment of dairy cows for warble flies is well worth while.

Internal morphology of the American cattle tick, W. E. ALLEN (*Studies Zool. Lab. Univ. Nebr., No. 67, pp. 245–280, pls. 4*).—On account of the thorough manner in which the external anatomy of the cattle tick has been studied and described, the author confines his attention in the present article to the discussion of the internal morphology alone. The methods of preserving ticks for microscopic study are described and notes are given on the anatomy of all of the internal organs. A brief bibliography relating to the subject is appended to the paper.

The Ixodidæ of the Argentine Republic, F. LAHILLE (*An. Min. Agr. Argentina Secc. Zootec., Bact., Vet., y Zool., 2 (1905), No. 2, pp. 166, pls. 13, figs. 23*).—This constitutes an elaborate monograph of the Ixodidæ found in Argen-

tina. The ticks belonging to this family and also the genus Argas are described with notes on their habits, life history, and economic importance.

The blood parasite which causes Texas fever and is carried by cattle ticks is discussed with particular reference to its proper name. The author believes that this should be *Babesia bovis*. Analytical tables are presented for the identification of various species of the Ixodidæ. A tabular list is also given showing the name of the tick, the name of the discoverer, the host, and locality. The genus Boophilus is retained and the common cattle tick is referred to under the name *B. annulatus*. The form found in Argentina may be a variety of the typical species.

From the literature of the subject and also from experiments carried out by the author data are presented regarding the reaction of ticks toward light, tobacco fumes, sarnol, and other substances. The subject of insecticides and dips for the destruction of ticks is presented with particular reference to American experiments in this field. It is held that ticks may be exterminated by a suitable system of pasture rotation.

Experiments with bees, S. A. BEDFORD (*Canada Expt. Farms Rpts. 1905, pp. 345, 346*).—Last year the bees were not placed in their winter quarters until November 28. A corner of a cellar under a residence is used for this purpose, being partitioned off, kept dark, and the temperature regulated as uniformly as possible. The amount of honey consumed during the year was 6 to 28 lbs. per colony with an average of 14 lbs. A test of the importance of ventilation in wintering bees indicated that it is not necessary to have a current of air passing through the hives provided the cellar is kept well ventilated.

A bee scale, C. DÉCHÉ (*Apiculteur, 50 (1906), No. 4, pp. 143, 144, fig. 1*).—A description is given of a simple scale weighing only 30 lbs. and capable of easy transportation from place to place. The scale is especially adapted for weighing colonies of bees, but may also be used for other purposes.

Beehives and bee keepers' appliances, P. N. HASLUCK (*London: Cassell & Co., Ltd., 1905, pp. 160, figs. 155*).—The present volume contains a digest of information relating to beehives and other appliances necessary in bee raising. The material of the volume is arranged in chapters on bar-frame hives, temporary hives, tiering bar-frame hives, stocking beehives, permanent and temporary observatory hives, inspection case for hives, queen-rearing hive, bee smokers, honey and wax extractors, and miscellaneous appliances for bee keepers. The various devices described in the volume are well illustrated.

FOODS—HUMAN NUTRITION.

Some forms of food adulteration and simple methods for their detection, W. D. BIGELOW and B. J. HOWARD (*U. S. Dept. Agr., Bur. Chem. Bul. 100, pp. 59*).—The common forms of adulteration met with in baking powders, alcoholic and nonalcoholic beverages, canned vegetables, cocoa, chocolate, coffee, tea, condimental sauces, dairy products, flavoring extracts, fruit products, meat preparations, and other food products are described and discussed, and data summarized in tabular form showing the extent of adulteration as determined by American investigators.

Sugar, flour, and cereal breakfast foods, it is stated, are practically free from adulteration. "The rumors which have been circulated from time to time that arsenic and other poisonous substances are used in breakfast foods have been entirely without foundation. . . .

"There is an impression in some quarters, unfortunately, that flour is adulterated with ground gypsum or other mineral matter. It is also believed by many that alum is used for the purpose of whitening bread. It may be said, however, that these forms of adulteration are not practiced in this

country. . . . At the present time there is probably no product on our market more free from adulteration than wheat flour.

"Some adulteration is practiced in special kinds of flour. For instance, much of the so-called gluten flour on the market is not at all what it purports to be. Frequently untreated wheat flour is sold for gluten flour. Buckwheat flour and other special articles of that nature are also frequently adulterated with cheaper cereal products.

"As a class the sugars, both high and low grades, as found on the market are practically free from adulteration. During recent years, however, a product has been put on the market to a limited extent which consists of a mixture of cane sugar with starch sugar (glucose) and saccharin, the latter being an artificial sweetening material derived from coal tar. There is a popular belief that granulated sugar is often adulterated with white sand or pulverized rock, and that pulverized sugar is commonly adulterated with starch or lime dust. Cases of such adulteration, however, have never been found by this Bureau, and it may safely be said that they occur rarely if at all."

Simple methods are described for detecting the forms of food adulteration and sophistication which are most likely to occur.

Cotton-seed meal for bread, J. H. CONNELL (*Texas Farm and Ranch, 25 (1906), Nos. 20, pp. 12, 13; 21, p. 12*).—The author believes that cotton-seed meal may be used to advantage as a constituent of bread and other articles of food, and in connection with a lecture on the subject exhibited samples of foods made in part of cotton-seed meal.

On the protein substances of barley, in the grain itself and during the brewing processes, H. SCHJERNING (*Compt. Rend. Lab. Carlsberg, 6 (1906), No. 4, pp. 229–307, pls. 2, dgms. 3*).—From an extended study of the composition and changes in nitrogenous materials in barley during growth, ripening, and storage some general conclusions were drawn from which the following are quoted:

"An appreciable amount of proteose in a barley crop must always be considered as indicative of rather unfavorable harvest conditions.

"A loss of dry matter (respiration loss) is not likely to take place during the storage of barley, provided the storage takes place under suitable conditions, and providing also the barley sample has reached a suitable degree of maturity before being reaped.

"If reaped at an early stage, barley is less rich in nitrogen than it is if reaped later.

"The chemical composition of dry matter in respect of the various groups of nitrogenous substances, mineral constituents, and water-soluble acid combinations is, properly speaking, not dependent on the species, variety, or type of barley.

"The cultural condition of the soil, as also climatic conditions, exert some influence on the amount of mineral constitutents in barley dry matter, and to a certain extent also upon the amounts of total nitrogen and amin-amid nitrogen, whereas with regard to the other groups of nitrogenous substances, the influence of these factors is less marked than the degree of maturity and time of storage."

Preparation of vegetables for the table, MARIA PARLOA (*U. S. Dept. Agr., Farmers' Bul. 256, pp. 48*).—Data are summarized regarding the structure and composition of vegetables, their classification, the principles which underlie vegetable cookery, wastes in preparing and cooking vegetables, the changes induced by cooking, and similar questions, and a number of typical recipes for cooking vegetables are given. In considerable part the data are based on the author's studies and experiments on the theory and practice of vegetable cookery.

The food of natives, A. Loir (*Rev. Sci. [Paris], 5. ser., 5 (1906), No. 19, pp. 590–592*).—The author reports observations on the diet of native laborers in South Africa, with special reference to the effect of diet on health. He considers that the monotonous diet, different in character from the food to which they were accustomed, was responsible for the illness observed. The article contains information on native foods and food habits.

Statement of information collected by the board of education and the foreign office regarding methods adopted in great continental and American cities for dealing with underfed children, R. L. Morant (*London: Bd. Ed., 1906, pp. VI + 33*).—Data collected in a number of continental and American cities regarding supplying food to school children are classified and arranged.

A comparative study of various fruit and vegetable colors, C. H. La Wall (*Amer. Jour. Pharm., 77 (1905), No. 7, pp. 301–311*).—The action of reducing reagents on the natural colors of a number of common fruits and other vegetable colors and analin dyes was studied.

Except litmus and cudbear none of the vegetable colors was affected by the stannous chlorid reagent, though many were either rendered lighter or decolorized by zinc and hydrochloric acid. Most of the analin colors were discharged by both reagents. Stannous chlorid reagent and zinc and hydrochloric acid, therefore, are regarded as useful reagents for studying the nature of the color of fruit preparations.

Concerning the storage of oxygen, H. Winterstein (*Zentbl. Physiol., 20 (1906), No. 2, pp. 41–44*).—From experimental evidence the conclusion was reached that oxygen is not stored up in the nerve centers.

Physiological economy in nutrition (*Nature [London], 73 (1906), No. 1892, pp. 328–330*).—A critical discussion of recently published work by R. H. Chittenden (E. S. R., 16, p. 685) and O. Folin (E. S. R., 17, p. 167).

ANIMAL PRODUCTION.

Studies in the chemical dynamics of animal nutrition, S. B. Schryver (*Bio-Chem. Jour., 1 (1906), No. 3, pp. 123–166, figs. 2*).—The various theories regarding the functions of nitrogenous constituents of food stuffs are discussed with reference to the general economy of nutrition and investigations summarized which bear upon this topic.

As a contribution to this subject the author has studied the character of the residual nitrogen in the serum and tissues, and autolysis and the relation of autolysis to nutrition. The general conclusion reached as to the functions of nitrogenous food stuffs in nutrition is that "in order to maintain nitrogenous equilibrium, nitrogenous food stuffs must be ingested in such quantities and in such form that the ammonia produced therefrom in the digestive tract is sufficient to maintain the intracellular alkalinity of the liver and probably other tissues.

"In order to fully understand this mechanism it is of importance here to consider the products other than nitrogenous bodies which are formed during autolysis. Magnus-Levy has shown that the liver on autolysis under the most stringent precautions for asepsis yields carbonic and other organic acids, such as lactic acid; furthermore, the degradation products of fats and carbohydrates are of acidic nature—all would on hydrolysis or oxidation produce acids; it matters not, however, for the purposes of the present argument whether the acid products are produced from the stored-up food stuffs or from the bioplasm itself.

"We have, therefore, two classes of products producible, viz, nonnitrogenous acidic bodies and nitrogenous bodies; the production of the latter class, it has

been shown, is stimulated by the presence of the former. In well-nourished animals there is, however, always an excess of ammonia present, hence in this case the tissues will not become acid *in vivo*. The excess disappears gradually, however, if the animal is deprived of food. A certain stage will then be reached, when the production of acid exceeds the amount of ammonia available for neutralization; the autolytic enzym then comes into play, liberates amino acids, etc., which in their turn pass the alimentary tract, and by means of the metabolic processes there taking place liberate ammonia, which again inhibits the production of nitrogenous degradation products. Degradation of tissue should proceed, therefore, at a definite uniform rate. From the preliminary experiments carried out it seems that the production of acids is inhibited by the presence of acids; we have, therefore, a mechanism which tends to prevent excessive acidity or akalinity of the liver; in the presence of acid nitrogenous degradation products are formed, from which ammonia is produced in the digestive tract; it is possible also that the presence of alkali stimulates the production of the nonnitrogenous acid bodies. Further research is needed on this point.

"The production of nitrogenous degradation products proceeds also at such a rate that there is never a dearth of nitrogenous bodies in the blood stream, and the bioplasm of the tissues, especially the mucous membrane of the small intestine, can remain saturated with side chains, for we have seen that the liver of a fasting animal contains more residual nitrogen than does that of a well-fed animal.

"From these researches it follows that, while the animal derives most of its energy from the oxidation of carbohydrates and rapidly eliminates nitrogen from albumens, the latter, for all that, play an important rôle in nutrition, for the degradation products are needed, not only to satisfy, as Folin has suggested, the needs of endogenous metabolism of the organism representing the wear and tear of the tissues, but also to supply sufficient ammonia to maintain a certain amount of general intracellular alkalinity. In the absence of this amount, nitrogenous equilibrium ceases to be maintained."

Cattle feed and stock food, T. MACFARLANE (*Lab. Inland Rev. Dept. [Canada] Bul. 116, pp. 31*).—In the different Canadian inland-revenue districts 127 samples of feeding stuffs were collected and examined, including oil meals, cocoanut cake, gluten meal, calf meals, shorts, middlings, low-grade flour, bran chops, moulée, mixed feeds, corn meal, corn chop, cracked corn, corn feeds, barley meal, barley chop, chopped feeds, and provenders.

Forty samples of condimental feeds and similar goods were also examined. They were found to be largely artificial mixtures of grain products, oil-cake meal, organic substances, and inorganic salts. "In most of them the total ash is high, and in many of them the ash soluble in water is very high and consists almost entirely of common salt. It is certainly not necessary that as much as 20 per cent of it should be required for the preservation of a sound and wholesome food, and its addition seems to partake of the nature of a fraud. Occasionally sulphate of soda is present, perhaps to save time by administering a laxative simultaneously with the food, a practice which a veterinarian might possibly condemn. . . . Sometimes the total proteids are quite high, which is no doubt owing to an admixture of oil-cake meal. On the other hand, so far as nutritive value is concerned, many of these stock foods appear to be no better than bran or 'chop.' It is possibly on account of the added salt that these are dignified by the name of 'stock food.'"

Fodders and feeding stuffs, F. T. SHUTT (*Canada Expt. Farms Rpts. 1905, pp. 140–144*).—Analyses are reported of a number of samples of mixed feeds,

gluten meal and other corn by-products, linseed cake and meal, cotton-seed meal, distillers' grains, goose wheat, fall wheat, broken soda biscuit or crackers, rice meal, and condimental feeds.

Mealies grown at Potchefstroom (*Transvaal Agr. Jour., 4 (1906), No. 14, pp. 359–361*).—Analyses of 10 samples of corn are reported. On an average the samples were drier than American-grown corn, doubtless owing to the dry South African climate. They contained "less protein and fat, but more starch, while they are about the same so far as ash and crude fiber are concerned."

"It would appear from these analyses that flint varieties of mealies, so far as chemical composition goes, are decidedly preferable for feeding purposes to dent varieties, and that the soft corn is poorest in ash, protein ('flesh formers'), and fat, though richest in starch."

Castor bean by-products, A. Halenke and M. Kling (*Landw. Vers. Stat., 64 (1906), No. 1, pp. 51–86, figs. 13*).—Available data regarding the histology of castor-bean seed, the composition of seeds and by-products, castor-bean products as adulterants, and other questions are summarized.

Blood molasses as a feeding stuff, G. Montini (*Staz. Sper. Agr. Ital., 38 (1905), No. 9, pp. 785–798*).—Tests with farm animals are briefly summarized, showing the value of blood molasses as a feeding stuff.

Calculating rations, A. Stutzer (*Berechnung der Futterrationen. Berlin: Paul Parey, 1906, 2. ed., pp. 81*).—This is the second, revised, and enlarged edition of this popular treatise, which discusses the food requirements of different farm animals, the composition of feeding stuffs, method of calculating rations, and related questions.

Concerning the composition of animal fat, C. Schneider and S. Blumenfeld (*Chem. Ztg., 30 (1906), No. 6, pp. 53, 54*).—The chemical and physical constants of fat from seal, lynx, bear, crane, and other sorts of game are reported.

Live stock, J. H. Grisdale (*Canada Expt. Farms Rpts. 1905, pp. 47–51, 73–75*).—It is estimated that the average cost of feeding and care of work horses at the station is 32.33 cts. per working day.

The extensive use of bran in the place of oats has effected a very considerable saving in the cost of horse feeding during the year, and the value of bran and oats in different proportions as compared with oats alone was studied with 5 lots containing 2 work horses each, the grain ration being supplemented with mixed hay. On some of the rations there were small gains and on others losses, but in general the conclusion was reached that bran may "very safely and very profitably constitute a very large percentage of the meal ration of working horses. Probably equal parts bran and oats might be taken as a fair proportion in which to mix the two feeds. Where the mixture is being fed to horses with sound teeth there does not seem to be any particular advantage in grinding the oats."

Beef production, J. H. Grisdale (*Canada Expt. Farms Rpts. 1905, pp. 62–70*).—In short *v.* long feeding periods a lot of 9 steers was fed for 127 days in comparison with a similar lot fed 202 days. The average daily gains per steer in the 2 cases were 1.85 and 1.83 lbs., and the cost of a pound of gain 6.76 and 7.38 cts., respectively.

The influence of age on the cost of beef was studied, the average daily gain with 3-year-olds being 1.65 lbs. per head at a cost of 6.52 cts., with 2-year-olds 2.16 lbs. and 5.99 cts., with yearlings 2 lbs. and 4.3 cts., and with skim-milk calves under 8 months 1.54 lbs. and 3.4 cts.

Continuing earlier work (E. S. R., 17, p. 171), the cost of producing baby beef was studied with steers 2 years old, with steers 13½ months old, and with calves, full fattening rations and limited growing rations being compared in

each case. With 2-year-olds the greatest gain, 1.66 lbs. per head, was noted with a lot of 5 animals on a full fattening ration, the test covering 110 days, and the smallest gain, 1.19 lbs. per head, in the case of a similar lot fed a limited growing ration for 786 days. The greatest range in cost of gain was also noted with these lots, the values being 7.28 and 4.37 cts.

With the yearling steers the greatest gain, 2 lbs. per head per day, was noted on the full fattening ration, the experimental period covering 193 days, and the smallest gain, 1.47 lbs. per head per day, with a lot fed the limited growing ration for 169 days. With calves the daily gain on a limited growing ration was 1.3 lbs. per head in a test covering 201 days, and on a full fattening ration 1.54 lbs., the cost of a pound of gain in the 2 cases being 3.58 and 3.4 cts., respectively.

Cattle, R. ROBERTSON, S. A. BEDFORD, and A. MACKAY (*Canada Expt. Farms Rpts. 1905, pp. 287, 288–297, 341–343, 394–396*).—The herds kept at the Maritime Provinces, Manitoba, and Indian Head experimental farms are described and feeding tests reported.

At the Maritime Provinces farm, 8 steers fed loose in stalls gained 2,900 lbs. in 165 days as compared with 2,010 lbs. gained by a like number tied in stalls. Considering all the steers the average daily gain was 1.55 lbs. per head and the cost of a pound of gain 9.33 cts.

The influence of age on the cost of beef production was tested with 3-year-olds, 2-year-olds, and yearlings, 8 animals constituting a lot in each case. The 3-year-olds gained at the rate of 1.64 lbs. per head per day, the cost of a pound of gain being 8.76 cts. Similar values with the 2-year-olds were 1.70 lbs. and 8.44 cts., and with the yearlings 1.75 lbs. and 7.06 cts.

Continuing earlier work (E. S. R., 17, p. 171), full fattening and limited growing rations were compared. Summarizing the data it was found that steers fed a full fattening ration for an average of 637 days made an average daily gain of 1.49 lbs. per head, the cost of a pound of gain being 5.78 cts. Animals fed a limited growing ration for 1,108 days on an average gained 1.08 lbs. per head per day at a cost of 6.1 cts.

At the Manitoba experimental farm in a test covering 112 days, the average daily gain made by a lot of 6 yearlings was 1 lb. 11 oz. per head per day and by 6 2-year-olds 1 lb. 7 oz. under similar conditions of feeding, the calculated profit in the 2 cases being $2.22 and $2.51. The results were practically the same as those obtained in an earlier test (E. S. R., 17, p. 172). "There is very little profit in fattening steers when the difference between the buying price in the fall and the selling price in the spring is not more than $1 per 100 lbs."

At the Indian Head experimental farm the average gain of 4 2-year-old steers was 240 lbs. per head in a test covering 16 weeks and the calculated profit per steer $5.07. Similar values for a lot of 4 3-year-old steers fed a similar ration were 219 lbs. and $4.17.

Swine feeding, J. H. GRISDALE (*Canada Expt. Farms Rpts. 1905, pp. 70–73*).—Alfalfa, clover, and root pasture supplementing meal rations were compared with roots and meal fed in pens and with meal fed in pens without supplementary feed, using 5 lots of 5 pigs each.

In the 35 days of the test the gain ranged from 1.31 lbs. per head per day on root pasture to 1.77 lbs. with the lot fed roots inside. The gain was most cheaply made with the last-mentioned lot, costing 3.09 cts. per pound, and was most costly, 4.23 cts. per pound, with the lot fed meal without supplementary feed in pens.

When pigs were pastured on an acre of ripe peas "the returns in pork were not satisfactory, but the effect of the exercise and the peas together was wonderfully beneficial so far as form of pigs was concerned and so far as fitting them for finishing off for the packer when brought into the pens."

Swine, R. ROBERTSON, S. A. BEDFORD, and A. MACKAY (*Canada Expt. Farms Rpts. 1905, pp. 297, 298, 343, 344, 396, 397*).—Brief statements are made regarding the pigs kept at the Maritime Provinces, Manitoba, and Indian Head experimental farms.

At the Maritime Provinces farm 10 pigs pastured on clover, rape, and hairy vetch and fed milk and meal 1:1 made an average daily gain of 0.74 lb. from July 1 to October 1. A similar lot fed on milk and meal only made an average daily gain of 0.90 lb. per head. Both lots were then fed under like conditions until November 15, the average daily gains being 1.3 lbs. and 0.95 lb. per head, respectively.

At the Manitoba experimental farm 12 pigs pastured on brome grass and fed grain in addition gained 995 lbs., the calculated profit being $33.38.

First annual report of the Poultry Institute of the Province of Ontario, G. C. CREELMAN (*Ann. Rpt. Poultry Inst. Ontario, 1 (1905), pp. 87*).—A brief account of the meeting and a number of papers by different authors on various problems connected with poultry feeding. In one of these, entitled "Dry Feeding: The New Poultry Culture," by A. F. Hunter, the experience of a number of practical feeders on the value of dry rations for poultry is summarized.

Report of the poultry manager, A. G. GILBERT (*Canada Expt. Farms Rpts. 1905, pp. 233–261, pl. 1*).—Recent changes in the local poultry market are discussed, as well as other general questions of poultry feeding, and the results of tests on a variety of topics reported.

A progress report is made of tests undertaken with a view to building up prolific and satisfactory strains of poultry. Trap nests were used to insure accuracy in the individual egg records kept.

When hens 2 or 3 years old were compared with pullets the older birds produced the greater number of eggs. "To secure early winter layers in either cold or partly warmed houses the pullets should be hatched early and come from strong and vigorous parent stock. To have prolific layers of large eggs in either unheated or partly warmed houses the pullets should come from hens which have proved to be good layers of large eggs." The rations fed to these lots and the method of feeding are described in detail.

In the incubator tests it was found that eggs from hens kept in cold houses showed the greatest percentage of fertility and hatched the most chickens, facts which were brought out in earlier tests (E. S. R., 17, p. 175). The eggs with the weaker germs were laid by hens kept in partially warmed houses. The same rations were fed in both cases. "Eggs were turned once per day after cooling. During the cooling of the eggs the doors of the incubators were left open. Neither incubator required any moisture."

Eggs from hens which had laid well during the season and had a free run "showed remarkable fertility and strength of germ." Records were kept to ascertain how soon after mating eggs would hatch vigorous chickens. The shortest time recorded was 41 hours 50 minutes.

Poultry, R. ROBERTSON, S. A. BEDFORD, and A. MACKAY (*Canada Expt. Farms Rpts. 1905, pp. 298, 299, 344, 345, 397*).—The poultry kept at the Maritime Provinces, Manitoba, and Indian Head experimental farms are briefly spoken of.

At the Manitoba experimental farm 4 Plymouth Rock cockerels fed ground grain gained 4 lbs. in 21 days, the cost of feed being 24 cts., as compared with 3 lbs. gained by a similar lot fed the same grain ration (wheat and oats 3:1) unground, the cost of the feed in this case being 21 cts.

At the Indian Head experimental farm the records kept showed that Light Brahmas averaged 47 eggs each from April to October as compared with 56 eggs laid by Black Minorcas and 78 eggs laid by Plymouth Rocks.

DAIRY FARMING—DAIRYING.

Further investigations on the influence of individual food constituents upon milk production, A. Morgen, C. Beger, and G. Fingerling (*Landw. Vers. Stat., 64 (1906), No. 2-3, pp. 93-242*).—The investigations previously noted (E. S. R., 16, p. 696; 17, p. 286) were continued in a somewhat modified form during 1905. Eight sheep and 2 goats were made use of in the 3 series of experiments conducted.

The addition of fat to a ration poor in fat and protein increased to a marked extent the yield of milk and milk constituents and also the percentages of fat and total solids. The addition of protein to the same basal ration increased to a still greater extent the yield of milk and milk constituents, with the exception of the fat, which showed a decided diminution. The percentage of total solids was also reduced. The simultaneous addition of both fat and protein increased the yield of milk and fat and compensated for the unfavorable influence of the protein when added alone. The refractometer number of the milk fat was increased by the addition of fat to the ration, but was not affected by the addition of protein.

When the protein in a ration rich in protein and poor in fat was replaced to a greater or less extent by thermically equivalent quantities of fat, practically the same results were obtained. The yields of milk, total solids, sugar, and proteids were reduced and the yield of fat was increased both in percentage and absolute amount. The most favorable influence of the fat was exerted when the average amount fed was 1 gm. per kilogram live weight. The refractometer number of the milk fat increased approximately in proportion to the substitution of the fat for protein in the ration.

The substitution of a thermically equivalent quantity of fat for a part of the carbohydrates in the ration rich in protein and poor in fat increased the yield of milk and milk constituents, especially the fat.

These results, confirming those of the previous investigations, indicate that food fat is better suited for the production of milk fat than protein and carbohydrates and is the only food constituent which exerts a specific influence in this direction, as is shown not only by the yield of fat but by the changes in the properties of the fat. Protein and carbohydrates exert no such specific influence.

The influence of emulsified and nonemulsified fats of different kinds upon milk production, C. Beger (*Landw. Vers. Stat., 64 (1906), No. 2-3, pp. 249-252*).—This is a preliminary report on experiments with 1 sheep and 1 goat in which the influence upon milk production of feeding butter fat, peanut oil, palm-nut oil, and fat extracted from hay was studied. Of the 4 fats, butter fat exerted the greatest stimulating influence and hay fat the least. The palm-nut oil produced a marked lowering of the refractometer number. Further experiments are considered necessary in order to determine whether the differences observed are important or are within the limits of experimental error. A favorable influence was believed to be exerted by feeding the fats in the form of an emulsion.

Influence upon milk secretion of concentrated feeds rich and poor in fat when fed with different coarse feeding stuffs, G. Fingerling (*Landw. Vers. Stat., 64 (1906), No. 4-5, pp. 299-412*).—In these experiments, conducted with 2 goats, the substitution of rice meal rich in fat for barley feed poor in fat increased both the absolute yield of fat and the percentage of fat in the milk. This effect was considered due to a specific influence of the food fat upon the milk fat, and this was more apparent as the difference in the fat content of the 2 rations was increased.

By feeding a concentrated feeding stuff rich in fat along with an unsuitable coarse feeding stuff, such as hay which had been subjected to the effects of rain, it was possible to increase the yield of milk fat up to or above that produced by normal hay supplemented by a concentrated feeding stuff poor in fat, the ration so composed having an average fat content. It is believed that this result would prove of practical value if confirmed by experiments with cows.

In confirmation of earlier results obtained by the author (E. S. R., 17, p. 70) the experiments showed the importance for milch cows of the aromatic, stimulating, or condimental substances normally present in sufficient quantities in feeding stuffs. When deficient, however, as in weathered hay, they can best be supplied by the addition of normal hay, or occasionally by seeds like fennel and anise, rather than by the use of the commercial condimental stock foods.

On the influence of feeding cocoanut cake upon the composition of butter fat with special reference to the Polenske number, M. Siegfeld (*Milchw. Zentbl., 2 (1906), No. 7, pp. 289–295*).—Tests made with 7 cows showed that feeding cocoanut cake exerted no apparent influence upon the Reichert-Meissl number but increased slightly the Polenske number and influenced to a much more marked extent the saponification number, iodin number, and the average molecular weight of the nonvolatile fatty acids.

First annual report of grade dairy herd, R. S. Shaw and A. C. Anderson (*Michigan Sta. Bul. 238, pp. 161–176, pl. 1, figs. 4*).—In 1904, the college purchased a grade dairy herd of 20 cows and planned to breed 5 cows and their female progeny to pure-bred Jersey bulls, 5 to Holstein, 5 to Guernsey, and 5 to Shorthorn bulls.

This bulletin is a report on the milk and butter production and the food consumption of this herd for the first year of the experiment. The average production of the herd for the year was 6,258.9 lbs. of milk and 298.25 lbs. of butter. Eliminating the poorest cow, which produced only 1,205 lbs. of milk and 48 lbs. of butter, the remaining 19 cows averaged 6,525 lbs. of milk and 311.4 lbs. of butter. The average profit per cow over cost of feed was $36.58. The poorest cow was kept at a loss of $9.88 and the best at a profit of $60.29. An account of the feeding and management of the herd is given and illustrations of 4 of the cows are included.

Testing individual cows, H. A. Hopper (*Illinois Sta. Circ. 102, pp. 40*).—This circular, which emphasizes the importance of studying the production of individual cows, contains records for one year of 18 dairy herds in Illinois, including 221 cows.

The average production was 5,616.99 lbs. of milk and 226.63 lbs. of butter fat. The best herd averaged 350.17 lbs. of butter fat and the poorest 142.05 lbs. The best 10 cows averaged 388.75 lbs. of butter fat and the poorest 10, 109.42 lbs. It is believed that at least one-third of the cows in the ordinary herds are practically unprofitable. A marked improvement was observed in herds where grading had been practiced. It was found possible to remove 5 cows from a herd of 10 and thereby increase the profit $7.62 per head.

Butter tests with Shorthorn and Jersey cows, J. H. Burton (*Jour. Bd. Agr. [London], 13 (1906), No. 4, pp. 193–200*).—Ten Jersey and 6 Shorthorn cows on an average were tested once or twice a month from November, 1900, to July, 1904, the total number of tests being 86. A test consisted in taking 50 lbs. of the mixed milk of each breed, separating it, churning the cream after 2 days and determining the amount of butter produced.

On an average 1 lb. of butter was made from 27.92 lbs. of Shorthorn milk and 19.09 lbs. of Jersey milk. In these tests the Shorthorns produced 650 gal. of milk and the Jerseys 500. The relative profits of the 2 breeds are discussed from various standpoints. Under the local conditions of the experiments the Jerseys

were not considered profitable, as the extra return in butter was more than compensated by greater barrenness, a higher death rate from tuberculosis and milk fever, and other causes.

Dairy herd records, J. H. GRISDALE, R. ROBERTSON, and S. A. BEDFORD (*Canada Expt. Farms Rpts. 1905, pp. 51–61, 287, 288, 343*).—Records are given of 35 cows at the central experimental farm, 22 cows at the experimental farm for the Maritime Provinces, and 10 cows at the experimental farm for Manitoba. At the central experimental farm tests were made of the feeding value for cows of a by-product from distilleries and of 2 cereal food by-products. A test was also made of feeding refuse apples to dairy cows, the results showing a slight increase in the rate of milk production when apples were fed as compared with a considerable decrease when apples were not fed.

Dairy herd, G. H. TRUE (*Nevada Sta. Rpt. 1905, pp. 42–44*).—Records of 7 cows for 1 year and 4 cows for short periods are reported.

Story of Rose and Queen, W. J. FRASER, (*Illinois Sta. Circ. 103, pp. 4, figs. 2*).—The first cow mentioned produced on an average for 10 years 384 lbs. of butter fat per year at an annual profit of \$56, while the second cow produced only 152 lbs. of butter fat per year for 6 years at an annual loss of \$2. These two records are discussed with reference to conditions prevailing among dairy herds in Illinois.

On the fat content of milk and its variations, E. UJHELYI (*Milchw. Zentbl., 2 (1906), No. 7, pp. 303–313*).—The data collected by the author show that the milk produced in Hungary contains on an average about 3.8 per cent of fat. That feeding has no practical influence upon the percentage of fat in milk is considered as shown by the similarity in the milk from small farms and large estates. A monthly or seasonal variation in the fat content of milk is attributed to the stage of lactation. The poorest milk was obtained in March and April and the richest in October, November, or December.

Some causes affecting the profits of dairying, F. S. COOLEY (*Mass. Crop Rpt., 19 (1906), No. 2, pp. 28–36*).—The subjects discussed include the kind of cows kept, the manner of replacing cows in dairy herds, the use of condimental feeding stuffs, causes of variation in the quality of milk, and the value of milk-test associations. Experimental evidence is cited in support of the views presented. The general use of condimental feeds is stated as acting adversely on the profits of the dairy.

Contribution to the study of the soluble proteids of milk, LINDET and L. AMMANN (*Rev. Gén. Lait, 5 (1906), No. 16, pp. 361–371*).—According to the authors, milk contains a soluble compound of casein and calcium phosphate designated calcium phosphocaseinate. Rennet, salts, alcohol, and acetic acid precipitated only a part of this compound, which is accordingly believed to exist in milk in solution as well as in a colloidal state.

Milk therefore contains 2 soluble albuminoids, albumin having a rotary power of −30° and calcium phosphocaseinate having a rotary power of −116°. The rotary power of the total albuminoids in the samples of milk examined varied between −62 and −74°. Based upon this difference in rotary power a method for determining approximately the quantity of albumin in milk is suggested and the results of a number of determinations are reported.

The authors attempt to refute the theory of Hammarsten that under the influence of rennet casein is transformed into paracasein insoluble in the presence of calcium salts and a soluble proteid representing about 10 per cent of the total nitrogenous material, on the grounds that the serum obtained by curdling milk with rennet contains less albuminoid matter than serum obtained by filtration through kaolin, and moreover, that the rotary power of the proteids not

affected by coagulation with rennet is the same as that of the soluble proteids in the milk. Coagulation is believed to be explainable only as a physical phenomenon.

The globulin of milk, L. MOROCHOWETZ (*Physiol. Russe, 4 (1906), No. 68–74, pp. 48–96*).—This is an extended review of the literature of milk proteids, all of which are considered by the author products of one and the same substance, designated lactoglobin.

Upon the reduction of methylene blue by cow's milk, E. P. CATHCART (*Jour. Hyg.* [*Cambridge*], *6 (1906), No. 3, pp. 300–303*).—Raw milk decolorizes a mixture of formalin and methylene blue, depending upon the action of catalase in the milk. As this ferment is destroyed by heating to 65 to 70° C., this test, known as Schardinger's, serves well to differentiate between heated or boiled milk and raw fresh milk. It has been suggested by H. Smidt that a further use might be made of this test as a means of determining the degree of bacterial contamination of milk.

In studying the possibilities of this test the author ascertained that in order to get reliable and constant figures a very definite temperature must be employed. A rise in the temperature of the water bath from 40° to 50° was found to cause a diminution of practically 50 per cent in the time required for reduction. Another possible source of error arises from the fact that the catalase is found almost completely in the cream and hence a sample taken from the bottom and another from the top layer of milk that has been allowed to stand for some time would show a marked difference in results. This reaction is also affected by heat and the age of the milk, the latter due probably to the increased bacterial content. Earlier experiments in which the author cooperated showed that the reducing action of organisms varies to a marked degree.

In view, therefore, of the many possible sources of error the author considers this test as a means of estimating the bacterial contamination of milk too delicate for ordinary use, but that it might possibly be of value in a large laboratory where the various sources of error could be readily eliminated.

Quality of milk affected by common dairy practices, W. A. STOCKING, Jr. (*Connecticut Storrs Sta. Bul. 42, pp. 62–90, figs. 2, dgms. 8*).—This bulletin gives the results of a large number of experiments made to determine the effect upon the bacterial content of milk of some common dairy practices, such as feeding dry feeding stuffs at milking time, wiping off the cows with a damp cloth or brushing them at milking time, rejecting fore milk, etc.

The bacterial content of the milk was greatly increased by giving dry feeds just before or at milking time. This was more marked in the case of corn stover than hay or grain. Wiping the flanks and udder of the cow with a damp cloth just before milking was very efficient in reducing bacterial contamination, while brushing the cows at this time increased the germ content of the milk. Thorough stripping reduced the number of bacteria found in the milk at the next milking. Rejecting the fore milk reduced slightly the germ content of the remaining milk, but the difference was so small that the practice is considered as probably of value only where an extremely low germ content is desired.

Several experiments were made to determine the extent to which individual milkers affect the germ content of the milk. Five students trained in dairy bacteriology and the production of clean milk were compared with 2 regular milkers. Although stable conditions were identical and the same procedure was followed in each case, there was an average difference of 1,932 bacteria per cubic centimeter in favor of the students. A college graduate in charge of the dairy herd was also compared with the regular milkers. In this case the difference in the bacterial content of the milk as an average of 19 tests was 14,650 bacteria

per cubic centimeter in favor of the college graduate. The differences are accounted for only by the difference in the care exercised by the individual men in their work.

The motile and nonmotile aerobic gas-producing bacteria in milk, T. GRUBER (*Centbl. Bakt.* [*etc.*], *2. Abt., 16 (1906), Nos. 20–21, pp. 654–663; 22–23, pp. 711–719*).—Descriptions are given of 28 strains of aerobic gas-producing bacteria belonging to the *Bacillus coli* and *Bacterium aerogenes* groups, compared and classified according to morphological and cultural characteristics.

The motile organisms were not uniformly peritrichous and hence the designation *Pseudomonas coli* is preferred to *Bacillus coli.* Cultural characteristics, especially the growth on gelatin plates, were found insufficient to distinguish the coli and aerogenes groups. Organisms in both groups were found capable of producing indol and nitrites. The gas-producing properties of the 2 groups permit the recognition of clearly defined subgroups, but do not permit of a sharp distinction between the organisms of the 2 groups. The characteristic so-called stable odor was produced on agar cultures and in fermented milk by the individual organisms of both groups.

A contribution to the bacteriology of milk, A. MACCONKEY (*Jour. Hyg.* [*Cambridge*], *6 (1906), No. 3, pp. 385–407*).—Bacteriological studies were made of organisms isolated from milk as sold for domestic use and from milk obtained directly from the cow. The results obtained are reported in detail and support the general opinion that gas-forming bacteria are not normally present in milk, but that they gain access to it through want of care and cleanliness in milking and handling the milk.

No gas-forming organisms were found in samples drawn directly from the cow. It is considered practicable to obtain milk containing when freshly drawn less than 1,500 organisms per cubic centimeter and with no gas-forming organisms in at least 50 cc. The presence of gas-forming organisms is considered as showing fecal contamination. Those most frequently found in fresh milk were *Bacillus oxytocus perniciosus*, *B. neapolitanus*, and *B. coli communis*, while those appearing at a later stage were *B. cloacæ* and *B. lactis aerogenes.* Out of 107 non-chromogenic lactose fermenting organisms isolated from milk only one gave the reaction of *B. acidi lactici.*

In the routine examination of water and food stuffs for the identification of organisms the author would substitute the fermentation of dulcit, adonit, and inulin, and Voges and Proskauer's reaction for the character of the growth on nutrient gelatin, action on milk, formation of indol, fermentation of glucose, and action on neutral red now generally employed.

A bacteriological study of the certified milk of Philadelphia, A. H. STEWART (*Amer. Jour. Med. Sci., 131 (1906), No. 4, pp. 625–635*).—The bacteriological standard of the milk commission of the Pediatric Society of Philadelphia requires that milk to be certified must not contain injurious organisms nor more than 10,000 bacteria per cubic centimeter.

Five dairies furnish certified milk. Samples of milk from these dairies were collected at frequent intervals from July, 1904, to August, 1905, and examined for pus cells and bacteria. The results showed that 57.4, 16.5, 36.5, 35, and 23.1 per cent of the samples of the 5 dairies respectively were below standard. Streptococci were occasionally present. The number of pus cells ranged from 100 to nearly 300,000 per cubic centimeter, the number usually being well up into the thousands. The milk of one dairy which guaranteed a lower bacterial count than 5,000 per cubic centimeter was below standard in 81.2 per cent of the 16 samples examined.

The author states that most of the certified milk is stored for 24 hours in Philadelphia before delivery and when examined at the end of this period almost

none complies with the standard. While admitting that the bacterial counts of the certified milks were rather disappointing, the author believes that these milks are probably among the best produced in this country. With the present equipment of railroads, a standard of 10,000 bacteria per cubic centimeter is believed to be too hard to attain. Suggestions are made for the improvement of present conditions.

On the influence of high carbon dioxid pressure on the bacteria in water and milk, W. HOFFMANN (*Arch. Hyg., 57 (1906), No. 4, pp. 379–400, fig. 1*).—Subjecting water to a carbon-dioxid pressure of 50 atmospheres for 24 hours prevented the development of bacteria. The same was also true of water inoculated with typhoid, cholera, and dysentery organisms and subjected to the same pressure for 3 hours.

Milk treated in the same manner for 24 hours at 56° showed a precipitation of the casein. The bacteria, however, were capable of growth after being subjected to these conditions. Milk obtained under hygienic precautions and subjected to carbon-dioxid pressure remained sweet for 24 to 48 hours longer than the same milk not subjected to pressure. In diluted serum agglutinins were not injured by the influence of moderate pressure for 48 hours, though bacterial development was checked or prevented.

The preservation of milk, especially with hydrogen peroxid, A. BABES (*Abs. in Rev. Gén. Lait, 5 (1906), No. 16, pp. 381, 382*).—The author argues that hydrogen peroxid is superior to formaldehyde as a means of preserving milk to be used for the purpose of immunization against tuberculosis according to the method of von Behring.

Whole milk, skim milk, buttermilk, and cream, 1906 (*Lab. Inland Rev. Dept. [Canada] Bul. 121, pp. 45*).—Of 319 samples of whole milk analyzed, 45 were pronounced adulterated and 85 doubtful. This was more unfavorable than the results obtained in previous years. Twenty-nine samples of cream examined showed percentages of fat ranging from 12.63 to 33.51. The author believes that the following standard should be established in Canada: Whipping cream not less than 25 per cent of fat, and table cream not less than 17.5 per cent.

Further bacteriological investigations of the butter of Stuttgart, A. REITZ (*Centbl. Bakt. [etc.], 2. Abt., 16 (1906), Nos. 22–23, pp. 719–733; 25, pp. 776–794, pl. 1, dgm. 1*).—The earlier investigations (E. S. R., 17, p. 1109) were conducted for the purpose of determining the presence of tubercle bacilli in butter. In the present investigations 30 samples of butter were examined for the presence of typhoid and diphtheria bacilli, negative results being obtained.

Typhoid bacilli added artificially to butter made from sweet cream were found alive at the end of 10 days, but not after 15 days. In butter made from sour cream the typhoid bacilli were alive after 7 days, but not at the end of 10 days. The total number of bacteria varied between 9,000,000 and 40,000,000 per gram. It is believed that insufficient attention was paid to pasteurization. For the determination of the total number of bacteria, gelatin was preferred to agar. During the first few days the bacterial content of the butter decreased, after which it increased rapidly for 2 to 3 weeks, when it was 2 to 3 times as great as at the beginning. The numbers then decreased. The species of bacteria found which were considered of special importance were *Bacterium coli commune*, *Streptococcus pyogenes*, *B. prodigiosum*, species of Actinomyces and Saccharomyces, and molds. The last 3 groups were considered as having a marked influence on the rancidity of the butter.

An extended bibliography of this subject is appended to the article.

Investigation of salt, A. HESSE (*Milchw. Zentbl., 2 (1906), No. 7, pp. 295–302*).—Analyses of 62 samples of dairy salt representing the different brands in

common use in Mecklenburg are reported, with comments upon the influence of the different impurities found in salt upon the quality of butter.

Contribution to the analysis of cheese, O. JENSEN and E. PLATTNER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 4, pp. 193–210*).—The authors are endeavoring to ascertain if differences capable of recognition by chemical methods exist between normal and faulty cheese. In this article the methods of analysis employed are described and analyses of 10 Emmenthal cheeses of different quality, 1 normal Cheddar cheese, and 1 old Backstein cheese are reported and discussed in detail, without general conclusions being drawn.

Investigations on the propionic fermentation in Emmenthal cheese, E. VON FREUDENREICH and O. JENSEN (*Ann. Agr. Suisse, 7 (1906), No. 4, pp. 221–242, pls. 2*).—The results of the investigations show, according to the authors, that the greater part of the propionic acid found in Emmenthal cheese is formed by specific ferments at the expense of the calcium lactate resulting from lactic fermentation. The process is represented by the following equation:

$$3C_3H_6O_3=2C_3H_6O_2+C_2H_4O_2+CO_2+H_2O$$

Several of the propionic acid ferments are described. The carbon dioxid liberated in the fermentation is considered the principal cause of the holes formed normally in Emmenthal cheese. Outside of the propionic-acetic fermentation there occurs often a pure acetic fermentation of the calcium lactate, due as much to propionic ferments as to lactic ferments.

Investigations on the butyric fermentation in Schabzieger cheese, E. VON FREUDENREICH and O. JENSEN (*Ann. Agr. Suisse, 7 (1906), No. 4, pp. 243–252*).—The origin of the butyric acid in the fermentation of this cheese was studied bacteriologically.

The authors isolated 2 bacilli which attack casein feebly and lactose vigorously and produce butyric, propionic, and formic acids in practically the proportions found in this cheese. The organisms are not believed to have anything to do with the ripening of the cheese. The butyric-propionic-formic fermentation in this cheese, like the propionic-acetic fermentation in Emmenthal cheese, is believed to be an accessory process independent of the ripening of the cheese, but important as regards the production of aroma.

Bacteriological studies of the abomasum and rennet, J. THÖNI (*Landw. Jahrb. Schweiz, 20 (1906), No. 3, pp. 181–242, figs. 2*).—Bacteriological studies of the fourth stomach, the whey used in preparing rennet, and natural rennet are reported, and many of the micro-organisms isolated, including some new species, are described.

The fourth stomach, used in the preparation of rennet, was found in general to have a fairly constant bacterial flora consisting of indifferent, injurious, and beneficial micro-organisms. The indifferent forms included cocci, species of Sarcina, and Streptothrix, *Bacterium fluorescens*, hay bacillus, potato bacillus, and a new species of Bacterium. The injurious organisms included *Bacterium coli*, *B. lactis aerogenes*, and 2 new species of Bacillus. The useful organisms included lactic-acid bacteria, propionic acid-producing organisms, and Mycoderma. Among the new organisms described 2 are considered of special interest—one designated *Bacillus 4 or B. acidi acetici*, an anaerobic acetic acid-producing organism, and *B. 5*, an organism found to produce late fermentation in cheese.

The different parts of the rennet stomach showed marked differences in the bacterial content. The pyloric end and fatty parts particularly showed high numbers of bacteria, consisting for the most part of the injurious forms. The whey used in the preparation of rennet was found to be poor in bacteria, and the few bacteria that were present were found to be without influence. The

indifferent forms were found to disappear quickly from the rennet, while the 2 other groups developed more or less rapidly in proportion to the numbers originally present in the stomach.

It is believed that in practice the growth of the beneficial bacteria may be favored by the observance of suitable precautions, such as the cleaning of the stomach, the discarding of the pyloric and fatty portions, which harbor especially the injurious organisms, and the keeping of the rennet at about 30° C. When prepared in this way, the beneficial organisms generally reach their highest numbers in about 2 to 3 days. Through the addition of a mixed culture of *Bacillus casei* ε and Mycoderma in the preparation of rennet it is believed that the practical value of the rennet is increased.

VETERINARY MEDICINE.

Report of the veterinary division, T. FLINTOFF (*Orange River Colony Dept. Agr., Ann. Rpt., 1 (1904–5), pp. 17–43, pls. 3*).—An account is presented by the veterinary staff of the Orange River Colony stock inspectors of the prevalence of various animal diseases in the colony, which are classified according to the animal affected. In horses particular attention is given to glanders, horse sickness, and osteoporosis; in cattle, to foot-and-mouth disease, African coast fever, and tuberculosis; and in pigs, to hog cholera and swine erysipelas. A statement is given regarding the number and condition of the government stallions in the colony.

A new disease in goats, called contagious catarrhal fever or goat distemper, is reported by H. K. Tasker. Goats affected with this disease show greatly swollen ears followed after 5 to 7 days by discharge from the nostrils and eyes. The disease reaches the crisis in about 14 to 18 days. At the height of the disease the animal will stand still much of the time, being unable to move except with a staggering gait. The period of incubation is 5 to 7 days. The disease appears to be contagious, although this point is not definitely determined.

The cause of halisterisis of the bones and therapeutic notes, KLIMMER and SCHMIDT (*Monatsh. Prakt. Tierheilk., 17 (1906), No. 11–12, pp. 481–517*).—The term halisterisis means deficiency of mineral matter and is used in preference to osteomalacia for the reason that it indicates the cause of the disease rather than the final condition observed in the bones as the result of the disease. The symptoms of halisterisis are described in great detail as observed in cattle, hogs, goats, dogs, and other animals.

In all cases the disease commonly referred to under the name rickets was due to the deficiency of mineral matter in the feed. On the basis of physiological experiments a table was prepared indicating the lime requirements of different domestic animals, according to their size, age, and sex. Other tables are presented showing the percentage of lime and phosphoric acid in a great variety of feed stuffs under different conditions. The literature on this subject is reviewed in connection with the bibliography of 127 titles. The authors come to the conclusion that halisterisis, being due to an insufficient amount of mineral matter in the feed, should be treated by the addition of suitable bone salts and phosphate of lime.

Immunity in tuberculosis, S. FLEXNER (*Pop. Sci. Mo., 69 (1906), No. 3, pp. 229–247*).—The more striking results obtained by investigators with regard to tuberculosis are briefly outlined with particular reference to the controversy started by Koch and to recent work of immunizing cattle and other animals to tuberculosis.

It is believed that no lasting or effective immunity toward tuberculosis can be obtained by the use of tubercle bacilli killed by heat or any other agency.

The artificial production of immunity to tuberculosis appears to rest upon the use of attenuated living tubercle bacilli. The possible danger from the use of human tubercle bacilli in immunizing cattle is also discussed.

Human and bovine tuberculosis, N. RAW (*Brit. Med. Jour., 1906, No. 2381, pp. 357, 358*).—In a continuation of his studies on the relationship of human and bovine tuberculosis, the author finds repeated confirmation of his previous conclusion that there are two forms of tubercle bacilli, but that man is subject to both and may readily become infected particularly in childhood by drinking tuberculous milk. The author believes that human tubercle bacilli do not attack the ordinary lymphatic glands of the body but produce lesions chiefly in the lungs. It is argued, therefore, that in most cases where the mesenteric glands are affected the tubercle bacilli are of bovine origin.

Experimental transmission of tuberculosis from man to cattle, A. EBER (*Ztschr. Fleisch u. Milchhyg., 16 (1906), No. 7, pp. 218–223*).—The material used in the inoculation experiments reported in this paper came from tuberculous mesenterial glands of human origin.

It is found possible by using this material in the inoculation of a bovine animal and subsequently making a reinoculation from this animal into another bovine animal to produce an acute miliary tuberculosis resulting in death within 6 to 7 days. Similarly when the material was first passed through a guinea pig and subsequently used for the inoculation of cattle death resulted within 51 days. In a third case, bacilli of less virulence were obtained.

It appears from these experiments that tubercle bacilli may be obtained from human cases of tuberculosis which are equally as pathogenic as bovine bacilli for cattle. The author argues, therefore, against the proposition of separating human and bovine tubercle bacilli on the basis of differences in virulence.

The origin of tuberculosis, J. BONGERT (*Deut. Tierärztl. Wchnschr., 14 (1906), No. 21, pp. 241–244*).—During the investigations carried out by the author it appeared that a diffuse tuberculous infiltration of the intestinal mucous membranes is often observed in cattle, and this trouble is caused by greatly attenuated tubercle bacilli. These bacilli show great differences in their morphological, cultural, and pathogenic properties. The author objects to the statement of Schütz that tuberculosis of cattle is always caused by the bovine type of tubercle bacilli for the reason that the type found in cattle is by no means constant. For example, highly virulent and greatly attenuated bacilli may be found in the same case of tuberculosis.

The relation between human tuberculosis and pearl disease of cattle, LYDIA RABINOWITSCH (*Berlin. Klin. Wchnschr., 43 (1906), No. 24, pp. 784–788*).—Summing up her investigations on the interrelation of human and bovine tuberculosis, the author comes to the conclusion that man may become infected with pearl disease, but that the frequency of such infection is still undetermined. A determined warfare against bovine tuberculosis is, therefore, necessary not only in the interest of animal industry, but for the protection of human health.

The nutrition of animals and tuberculosis, D. BONORA (*Gior. R. Soc. ed Accad. Vet. Ital., 55 (1906), No. 20, pp. 480–484*).—The relationship between the nutrition of animals and the development of tuberculosis is briefly discussed. It is maintained that a rational system of feeding in which a liberal and well-balanced ration is used should lie at the foundation of any system devised for the control of tuberculosis. This recommendation was made in the belief that properly nourished animals are less susceptible to tuberculosis than those which are suffering from malnutrition.

The pathogenesis of tuberculosis, H. VALLÉE (*Compt. Rend. Acad. Sci. [Paris], 142 (1906), No. 20, pp. 1101–1103*).—The author has continued his

studies on the comparative rôle of the digestive and respiratory organs as the primary location of tuberculous infection. It appears that in many cases in which the lungs and bronchial glands are affected most extensively, the original infection was located in the intestines and was due to ingestion of tuberculous material with the feed. The author believes that in this respect calves and children behave in the same manner toward tubercle bacillus. According to the author's investigations the source of infection must remain doubtful even in cases where the lungs and other respiratory organs are the only parts affected, for cases which are apparently of purely pulmonary origin may nevertheless trace their source of infection through the intestines.

The virulence of lymphatic ganglia in tuberculous animals, H. Vallée (*Compt. Rend. Soc. Biol.* [*Paris*], *60* (*1906*), *No. 19*, *pp. 911–913*).—A number of authors have called attention to the fact that lymphatic glands of apparently normal condition may contain tubercle bacilli. This fact has been noted most frequently in connection with experiments in immunizing cattle against tuberculosis by the use of human tubercle bacilli. In these cases the glands of the immunized cattle contained tubercle bacilli for a long time after apparent recovery from vaccination. The author finds that the mesenteric as well as other lymphatic glands of cattle, after tuberculous infection from any source, may contain virulent tubercle bacilli without showing any abnormal condition. It is concluded, therefore, that none of the lymphatic glands in a tuberculous animal may be considered as free from tubercle bacilli. The bearing of these investigations on the utilization of tuberculous meat is apparent.

Combating tuberculosis of cattle, J. Poels (*Tijdschr. Veeartsenijk.*, *33* (*1906*), *Nos. 8*, *pp. 477–496*; *9*, *pp. 535–548*).—Attention is called by the author to the great importance of a more thorough clinical study of tuberculosis in order to be able to recognize by the physical symptoms the first occurrence of tuberculosis in the lungs. It is believed that the extensive use of tuberculin and the complete reliance of most veterinarians upon this reagent have led to some neglect in the study of physical symptoms. The disease is admittedly more infectious when the lungs are attacked than when it is confined to other internal organs. The importance of being able to recognize the presence of the disease in the lungs is therefore obvious.

Four cases of equine tuberculosis on one farm, W. R. Davis (*Vet. Rec.*, *18* (*1906*), *No. 925*, *p. 678*, *fig. 1*).—The extensive development of tuberculosis was observed in a 4-year-old mare which had to be killed on account of the presence of the disease. Her colt likewise developed tuberculosis, and also two other horses on the same premises. The author calls attention to the relative infrequency of tuberculosis in horses, but notes the fact that there were 4 cases of the disease in horses during a period of 3 years on a small farm on which the owner never had more than 6 horses at a time.

A study of avian tuberculosis, V. A. Moore (*Ztschr. Infectionskrank. u. Hyg. Haustiere*, *1* (*1906*), *No. 4–5*, *pp. 333–340*).—A short account is given of the experiments carried on by the author with regard to the nature and transmissibility of tuberculosis in the fowl. It was found by feeding and inoculation experiments that avian tuberculosis can not always be transmitted to experimental animals, and also that human and bovine tuberculosis are not always easily transmitted to fowls. All of the author's experiments along this line gave negative results.

The immunity of Galleria mellonella toward tubercle bacilli, S. Metalnikoff (*Compt. Rend. Soc. Biol.* [*Paris*], *60* (*1906*), *No. 11*, *pp. 518*, *519*).—On account of the fact that tubercle bacilli are surrounded with a waxy envelop which appears to serve the purpose of protecting them against digestion and

destruction by the fluids of the animal organism in which they are found, the idea originated of determining whether animals which naturally digest wax are immune to the tubercle bacillus.

For this reason the bee moth was chosen as the most suitable species since it lives largely on beeswax. The insect was found to be absolutely immune to tuberculosis. When tubercle bacilli were inoculated into the larvæ of bee moths, the bacilli were rapidly destroyed, being transformed within a few hours into a brownish pigment-like mass. This destruction was accomplished partly by the ordinary leucocytes and partly by giant cells. It was found in experiments on guinea pigs that these animals when vaccinated with the blood obtained from bee moth larvæ were rendered highly resistant to tubercle bacilli. Further studies along this line are promised.

A biological method for demonstrating anthrax in practice, E. Jacobstahl and F. Pfersdorff (*Ztschr. Infectionskrank. u. Hyg. Haustiere, 1 (1906), No. 2–3, pp. 102–123, fig. 1*).—For the practicing veterinarian as well as for officials of the government veterinary service a rapid method of diagnosing anthrax is an important desideratum.

In order to obtain a reliable diagnosis, it is desirable to hasten the formation of spores as much as possible, and according to the authors' experience this may best be accomplished by placing the suspected material on a rod of gypsum previously moistened with bouillon or water. The bacteria which would naturally come into account in making a differentiation by this means are spore-forming anaerobes and nonspore-forming and spore-forming aerobes.

In making the diagnosis according to the method proposed by the author, the rod of gypsum is removed from the test tube and placed in clean water for about a minute, after which it is returned to the test tube. The amount of water in and on the piece of gypsum is sufficient to moisten the cotton placed at the lower end of the gypsum rod. The material for testing is preferably to be taken from the jugular vein, spleen, or blood clot in the heart, after which the suspected material was placed on the gypsum rod, the whole test tube enclosed in a shipping box and sent to the laboratory.

According to the extensive experience of Marxer, Ostertag, and others, this method yields positive results in many cases where others have failed for the reason that the spores develop very rapidly if the material contains anthrax bacilli.

The simultaneous inoculation method for anthrax, G. Sobernheim (*Berlin. Tierärztl. Wchnschr., 1906, No. 12, pp. 233–235*).—The method of combined inoculation with serum and cultures has found application in a large number of cases during the past year. One firm in Germany prepared over 200,000 doses, a large part of which was shipped to Argentina and Uruguay.

Notes are given on the distribution of anthrax in these South American countries and statistics are presented regarding the effectiveness of the method as shown by reports based on about 300,000 animals. These reports indicate that the method yields very satisfactory results. In the nearly 300,000 cases in which the combined inoculation has been applied not a single animal has died as the result of vaccination and the disease has been effectively checked and controlled wherever the method has been thoroughly applied.

Texas or tick fever and its prevention, J. R. Mohler (*U. S. Dept. Agr., Farmers' Bul. 258, pp. 45, figs. 6*).—The material contained in this bulletin is essentially a condensation of Bulletin 78 of the Bureau of Animal Industry (E. S. R., 17, p. 1190).

The treatment of cases of bloody urine in cattle with hemoglobin, Evers (*Berlin. Tierärztl. Wchnschr., 1906, No. 19, p. 364*).—Hemoglobin is dissolved in a 20 per cent itrol solution at the rate of 1 gm. to 5 cc. and should be used

within 24 hours after mixing. When administered hypodermically, it causes no bad effects at the point of inoculation. The author reports that he has used this remedy on more than 40 experimental animals, including horses, cattle, and sheep, in some cases administering as much as 500 cc. Considerable benefit is always manifested from the use of hemoglobin in cases where the amount is below normal.

Recurrence of parturient paresis, KAHN (*Berlin. Tierärztl. Wchnschr., 1906, No. 17, p. 322*).—In the experience of the author as well as that of other investigators, the recurrence of parturient paresis soon after an apparent recovery is very rare. Notes are given on a case in which air infiltration was used in the treatment of the disease. The cow recovered within a few hours, but suffered a relapse 5 days afterwards. Air infiltration into the udder was again administered, after which recovery took place without a recurrence of the disease.

Parturient paresis, GEBAUER (*Berlin. Tierärztl. Wchnschr., 1906, No. 20, pp. 377–379*).—In a brief review of the literature of this subject the author gives particular attention to the investigations of Hess and Zehl. The evidence thus far presented for considering parturient paresis as an infectious disease is not very strong. The most characteristic and pronounced symptom is cerebral anemia. The author believes that the often-observed cessation of the milk secretion in cases of this disease is an attempt on the part of the organism to compensate for the disturbed circulation. In one instance the author observed a case in which the symptoms were identical with those of parturient paresis and the infusion of air into the udder caused a prompt improvement, but later serious symptoms occurred and the animal was slaughtered. It was found in this case that the cerebral anemia was due entirely to a vaginal hemorrhage which had lowered the blood pressure.

Milk fever before parturition, GALLIER (*Bul. Soc. Cent. Méd. Vét., 83 (1906), No. 6, p. 153*).—This disease, while always related to parturition, sometimes occurs before as well as after this event. Notes are given on a case which came under the author's observations. A complete recovery took place after the application of the Schmidt treatment.

The treatment of infectious vaginal catarrh of cattle, H. RAEBIGER (*Berlin. Tierärztl. Wchnschr., 1906, No. 13, pp. 241, 242, figs. 4*).—In the treatment of this disease considerable difficulty has been experienced on account of the merely temporary effect of ordinary antiseptic washes.

The author devised a syringe, by means of which dry antiseptic materials and also salves could be injected. The results obtained from the use of this apparatus have been very satisfactory. It is considered, however, that in all cases in which the uterus is also affected the cow should be fattened and sold for beef since, if she is kept in the herd, it is practically impossible to prevent the further spread of the disease.

The enzootic appearance of gangrenous vaginitis in cows, A. M. BERGMANN (*Fortschr. Vet. Hyg., 4 (1906), No. 1, pp. 1–6*).—The disease occurs most frequently in connection with calving and attacks chiefly heifers and young cows. A brief account is given of the persistence of the disease from year to year in a badly infected herd. The cause of the disease is infection with the necrosis bacillus. In order to prevent infection of the milk of diseased cows, it appears to be necessary to make frequent use of lysol douches. This treatment should be applied immediately after parturition.

Notes on the enzootic occurrence of gangrenous vaginitis in cows, A. M. BERGMANN (*Svensk Vet. Tidskr., 11 (1906), No. 3, pp. 117–120*).—Several cases of this disease have come under the observation of the author. The usual symptoms and pathological alterations are described. Quite satisfactory re-

sults were obtained by the thorough application of washes of chlorid of zinc in 10 per cent solution.

Poisoning of cattle by Lima beans, G. MOSSELMAN (*Ann. Méd. Vét., 55 (1906), Nos. 3, pp. 141–153; 4, pp. 205–215*).—The seeds of various varieties of *Phaseolus lunatus* contain quantities of glucosid which is capable, after fermentation, of producing enough hydrocyanic acid to kill herbivorous animals which eat the beans.

According to experiments, 500 gm. of beans may be enough to kill a horse and if fed in larger quantities the result may be fatal even after cooking. Even the leaves of cultivated varieties were found to be toxic, but the toxicity varied greatly according to the age of the plants and the stage of vegetation. In cases where the plants or beans contained free hydrocyanic acid animals refused to eat them. This was found to be the case with rabbits and guinea pigs after allowing them to fast for 2 days. It is believed by the author that not all varieties of *P. lunatus* are poisonous, and it is suggested that this matter may depend somewhat on the soil and nature of the cultivation.

Mushroom poisoning in cows, HAGA (*Norsk Vet. Tidsskr., 18 (1906), No. 1–2, pp. 29, 30*).—In a small herd of cows in Suldal, 2 animals died as a result of eating poisonous mushrooms, apparently *Agaricus muscarius*. The symptoms were those which are commonly described as occurring in man and developed with great violence. There was profuse diarrhea accompanied with brain symptoms. No opportunity was had for testing any remedial measures.

Larkspur and other poisonous plants, G. H. GLOVER (*Colorado Sta. Bul. 113, pp. 24, pls. 8*).—The losses from poisonous plants in Colorado are annually a serious drain on the stockmen. The station in cooperation with the Bureau of Plant Industry of this Department is investigating a number of problems connected with poisonous plants.

In the present report a general discussion is given of the factors which determine plant poisoning and particular attention is given to larkspur, death camas, water hemlock, lupines, and rubber plant. As remedies for larkspur poisoning the author recommends drenches with potassium permanganate and a hypodermic injection of atropin. Descriptive and biological notes are also given on death camas, water hemlock, and lupines, with brief notes on curative methods. The bulletin also contains a feature of practical importance to stockmen consisting of a synopsis of symptoms and treatment to be applied in the poisoning of cattle, horses, and sheep by different plants under different conditions.

Geel dikkop, R. PAINE (*Jour. Compar. Path. and Ther., 19 (1906), No. 1, pp. 5–8*).—This disease, commonly known by its Dutch name, which means yellow thick head, affects chiefly Merino and Africander sheep and Angora goats.

The trouble usually appears in herds grazing on low land after a considerable rainfall. The head and ears swell greatly and a dropsical condition of these parts appears. The temperature often rises to 104° F. A certain percentage of cases may live for a week or more, but they usually end fatally. If no treatment is adopted, the swollen parts become dry, shrivel up, and crack. The general condition of jaundice is also observed. Most sheepmen believe that the disease may be prevented by removing the flock to high land where the disease is not prevalent and keeping the sheep corralled until after the dew is off in the morning.

When examined post mortem, affected sheep were found to show a general jaundiced condition, with a soft liver, inflammation of the gall bladder, and occasionally an enlargement of the spleen. Considerable benefit is to be derived from feeding the sheep on alfalfa and giving them plenty of good water. The average mortality is about 40 per cent. Occasionally the disease appears to be capable of transmission by inoculation, but the nature of the trouble is not well understood.

Bacteriological diagnosis of chronic swine plague, JUNACK (*Ztschr. Infectionskrank. u. Hyg. Haustiere, 1 (1906), No. 2-3, pp. 153-166, fig. 1*).—Data are given regarding the bacteriological diagnosis in a large number of cases of pure swine plague, combination swine plague and hog cholera, pure hog cholera, and intestinal catarrh of pigs. The bacteria obtained in these tests are enumerated.

It appears from the author's study that in case of the prevalent chronic form in swine plague a negative bacteriological finding does not decide the matter for the reason that the demonstration of *Bacillus suisepticus* fails in about one-third of the chronic cases of the disease. In such cases the anatomical findings and the infectiousness of the disease makes it possible to reach a diagnosis. Certain races of *B. suisepticus* when cultivated on artificial nutrient media form short rods in addition to long threads and retain both of these forms when inoculated into other animals or maintained from generation to generation on artificial media.

Active immunization against hog cholera, M. PRETTNER (*Berlin. Tierärztl. Wchnschr., 1906, No. 10, pp. 173, 174*).—Hogs were inoculated intraperitoneally with the organism of hog cholera and subsequently an exudate was obtained from these hogs which, after sterilization, was used in testing its immunizing power on other hogs. Four parallel tests were made in each of which one animal was treated with this exudate and the other not. In all cases the immune animals remained healthy without any reaction. The author believes that his experiments justify the hope of obtaining a method of producing active immunity in hogs by means of an exudate caused by *Bacillus suipestifer*, but not containing bacteria.

Glanders: Its nature, distribution, and prevention, P. FISCHER (*Ohio Live Stock Assoc. Bul. 6, pp. 9*).—The successful control of glanders in the author's opinion depends upon the education of horse owners in an understanding of the dangers of this disease and in a thorough appreciation of the wide distribution of the disease and the danger of allowing infected horses to be utilized in any way which will bring them in contact with healthy horses. Attention is called to the danger of infection from glanders in unsanitary stables, blacksmith shops, and from public watering troughs.

The establishment of a simple basis for judging mallein reaction, FOTH (*Fortschr. Vet. Hyg., 3 (1906), No. 11, pp. 241-249*).—The author summarizes a number of results obtained in the use of mallein for the purpose of determining the reaction which usually occurs in typical cases of glanders.

As a result of this study it is concluded that mallein is a suitable reagent for determining glanders in herds of horses at a comparatively small expense. At present, however, it is a difficult matter to establish an exact standard for the mallein reaction. In order that such a standard may be set up it is considered necessary to carry on experiments with horses artificially inoculated with glanders in order to be able to test them with mallein at periods of known length after the beginning of infection. Mallein must also be tested more extensively on horses known to be nonglanderous. It is considered desirable also to compare the mallein reaction with the results obtained by agglutination.

Malarial fever in horses, A. T. PETERS (*Nebraska Sta. Press Bul. 22, pp. 7, figs. 3*).—The symptoms and prevalence of this disease are briefly described. The disease has been observed in Nebraska since 1902 and has caused the death of many horses. Affected animals become gradually emaciated and the number of red blood corpuscles much reduced. The author did not succeed in obtaining cultures of any organism which might be considered as the cause of the disease. A parasitic worm was found in connection with the disease, and further study will be devoted to this parasite and to the possible occurrence of pathogenic bacteria.

Malaria in horses, G. J. BRICKMAN (*Svensk Vet. Tidskr., 11 (1906), No. 3, pp. 120–130, figs. 2*).—Particular attention is given in this account to the etiology of malaria in horses. The blood parasite was found in the red blood corpuscles and produced, during the course of the disease, a sort of pernicious anemia in the blood of horses. The disease is accompanied with profuse sweating and the thorough application of arsenical treatment appears to relieve this symptom and otherwise check the course of the disease.

The occurrence and treatment of inflammation of the lumbar part of the spinal cord, KULL (*Ztschr. Veterinärk., 18 (1906), No. 8–9, pp. 353–356*).—During the years 1904 to 1906 an infectious disease broke out among army horses and was referred to under the names infectious catarrh and inflammation of the lumbar portion of the spinal cord. The spinal affection was the more important part of the disease and is therefore retained as the more appropriate name. The disease was controlled by a thorough quarantine of all stalls in which infected animals had stood and by the use of antiseptic solutions in such connection. It was found possible to produce passive immunity of short duration against the disease by serum treatment.

Ill effects sometimes produced on horses and mules pastured exclusively upon alsike, M. JACOB (*Tennessee Sta. Bul., Vol XVIII, No. 3, pp. 28–30, fig. 1*).—A peculiar disease has been noted in certain parts of Tennessee as a result of pasturing too exclusively on alsike clover.

The disease affects only horses and mules and improvement takes place in mild cases as soon as the animals are removed from alsike pasture. The exact cause of the disease is not understood. The chief symptoms appear on the skin in the form of inflamed areas which are later sloughed off leaving sores. The eyes, tongue, mouth, and alimentary tract may also be affected. In cases where the skin only is affected, treatment is simple and consists in removing the animal from alsike pasture and treating sores with an antiseptic wash.

Recent investigations concerning rabies, L. PANISSET (*Rev. Gén. Méd. Vét., 8 (1906), No. 87–88, pp. 113–139*).—The literature of this subject is critically discussed in connection with bibliographical references. Particular attention is called to the recent investigations undertaken for the purpose of determining the most satisfactory methods of diagnosing rabies in a rapid and reliable manner.

The course of rabies virus and antirabies vaccine, P. REMLINGER (*Compt. Rend. Soc. Biol. [Paris], 60 (1906), No. 12, pp. 573–575*).—As a result of numerous experiments on laboratory animals it appears that rabies virus travels from the point of entrance into the organism toward the nerve centers along the peripheral nerves and that the antirabies vaccine passes toward the nerve centers in the lymphatic system. The results of vaccination, therefore, vary according to the relative rate of speed which these two substances take in their course toward the central nervous system.

The appearance of virulence in the saliva of rabid animals, J. NICOLAS (*Jour. Méd. Vét. et Zootech., 57 (1906), Apr., pp. 208–218; Compt. Rend. Soc. Biol. [Paris], 60 (1906), No. 13, pp. 625, 626*).—In the control of outbreaks of rabies among domestic animals it is of great importance to know as definitely as possible just when the saliva becomes virulent. For this purpose a number of inoculation experiments were made on goats, rabbits, and dogs. The virus in the saliva was found to be virulent from 4 to 6 days before the appearance of any symptom of the disease in dogs and goats and at least 4 days before the appearance of symptoms in dogs inoculated in the muscles.

A malignant infectious eye disease in fowls, RABUS (*Wchnschr. Tierheilk. u. Viehzucht., 50 (1906), No. 11, pp. 207, 208*).—In a flock of 12 fowls, 8

developed symptoms of a contagious eye disease consisting in intense inflammation of the conjunctiva which became covered with a mucous or purulent material. Some of the worst cases were killed while the less developed cases were treated by means of silver nitrate at the rate of 1 part to 6 in water.

The disinfection of stock cars by means of aqueous formaldehyde solutions, J. Schnürer (*Ztschr. Infectionskrank. u. Hyg. Haustiere, 1 (1906), No. 2–3, pp.* accomplished by the most thorough spraying of cars with formaldehyde for the for the purpose of determining the effectiveness of this method in destroying thoroughly reached with the formaldehyde solution.

The strengths of formaldehyde used were 1, 1½, and 2 per cent. When these applications were made at relatively low temperatures the effect was not as good as could be desired. Better results were obtained when a higher temperature was maintained in the cars. A complete disinfection can not be accomplished by the most thorough spraying of cars with formaldehyde for the reason that cars are not constructed so that every crack and crevice could be thoroughly reached with the formaldehyde solution.

Disinfection by means of formaldehyde and potassium permanganate, J. G. Cumming (*Rpt. Mich. Acad. Sci., 7 (1905), pp. 177–180*).—Claims have been made that when formalin is poured over potassium permanganate, a rapid process of oxidation takes place which leads to the liberation of formaldehyde gas in large quantities.

This matter was tested by the author, and during his experiments 3,000 specimens of infected silk threads, cloth, and filter paper were exposed to various conditions of disinfection. The organisms used in these experiments included anthrax bacillus, typhoid bacillus, streptococci, and various other bacteria. In these experiments the permanganate process was compared directly with the regular distillation method recommended by Novy. The results obtained indicate that the permanganate process is not as useful as the distillation method, but that the former method is so simple that it may be used effectively and safely by a layman.

RURAL ENGINEERING.

Primer of irrigation, D. H. Anderson (*Chicago: The D. H. Anderson Pub. Co., 1905, pp. 257, pls. 16*).—This is a volume which, according to the author, is intended to "lend aid to those who are beginners in irrigation farming."

In carrying out this idea the author considers his subject in its relation to other branches of agricultural science and takes up, in turn, the formation and qualities of soils, together with their treatment for alkali, etc.; plant foods and a simple exposition of the chemical processes involved in plant feeding; the tilling and laying out of land with special reference to irrigation farming; finally discussing in a popular way the more technical aspects of the subject, such as duty and measurement of water, pumps and irrigation machinery, etc. The author has compiled in a readable manner much information of value to those about to take up or already engaged in irrigation farming.

Investigation of irrigation practice in Oregon, A. P. Stover (*U. S. Dept. Agr., Office Expt. Stas. Circ. 67, pp. 30, figs. 4*).—This circular covers the work done in Oregon by Mr. Stover in 1905. The methods of preparing land for irrigation and of applying water are discussed from the standpoint of the needs of Oregon rather than describing Oregon practice.

One of the most interesting features of the circular is the discussion of flood water or winter irrigation in the Butter Creek Valley, where the water

supply during the summer is extremely limited. Large quantities of water are applied to the land when the streams are high in the spring, and with this heavy irrigation three crops of alfalfa are raised and orchards are also successfully maintained. The success of this form of irrigation is attributed to the impervious subsoil and peculiar formation of the valley which prevents the ground water from draining out.

Seepage measurements were made in a number of canals, showing large losses. The efforts made to check these losses in the Irrigon Canal are described at some length. Plowing and harrowing the silt in the bottom of the canals was tried without beneficial effect. Later a homemade device called a chain puddler was tried, with good results, the seepage loss after the use of this puddler being less than half that before it was used. This puddler consists of heavy chains attached to the ends of a beam placed across the running gears of a wagon and extending across the ditch. The chain drags on the bottom of the ditch, tears up the vegetation on the bottom of the canal, and puddles the silt.

The circular gives directions for preparing land for applying water by various methods, together with estimates of the cost of these operations.

Irrigation in the North Atlantic States, A. J. Bowie, Jr. (*U. S. Dept. Agr., Office Expt. Stas. Bul. 167, pp. 50, figs. 7*).—This report includes data collected during July and August, 1905, in a study of irrigation as practiced in Maryland, Delaware, Pennsylvania, New Jersey, New York, Rhode Island, and Massachusetts.

The territory investigated lies in the humid district of the United States, where the annual rainfall is between 40 and 50 in. and where irrigation is not always necessary for the growth of crops and has been confined to truck farms and meadow lands. Truck farmers in the vicinity of large cities frequently use city water at a cost of \$1 to \$1.50 per 1,000 cu. ft., or \$44 to \$65 per acre-foot. In spite of this prohibitive price when compared with western practice, those farmers practicing irrigation in the district covered seem to find it profitable. This is probably due to the fact that the yearly value of the truck crops is estimated as being increased 30 to 50 per cent. "As the cost of irrigation usually lies between \$30 and \$100 per acre it is fair to assume an acreage profit of \$200 or more per acre due to irrigation."

A large number of irrigation plants in the States covered are described in detail and from the study the following conclusions are drawn:

"The irrigation of meadows and truck farms is an established and profitable practice in the North Atlantic States, while the profitable irrigation of field crops has not been demonstrated as yet.

"The methods employed are very expensive compared with western practice, but are the outgrowth of peculiar conditions and meet the requirement of very small applications of water.

"The quantity of water required by truck crops either as rain or irrigation is about 1 inch in depth every week, and in the light sandy soils generally used it should be applied in quantities not exceeding 1 inch at a time."

An underflow canal used for irrigation at Ogalalla, Nebraska, C. S. Slichter (*Engin. News, 56 (1906), No. 1, pp. 4, 5, figs. 6*).—The writer gives the results of an investigation of this canal made during 1905.

The canal excavation is about 12 ft. wide at the bottom and about 6,500 ft. in length, extending along the south bank of the South Platte River and reaching a total depth in its upper portion of 5 ft. below the bed of the river. This is the only successful instance of a large number of such constructions which have from time to time been tried, and in the present case the writer thinks success is due to the small size of the canal and the unusually large slope of the

river at the point in question. The percolation into the canal per square foot of percolating surface was found to be 0.01 to 0.02 gal. per minute per foot of head. These figures are said to be low, "due to the vegetation and slime that obstructs the sand through which water must pass, but it is mainly due to the fact that stratified gravels do not readily transmit water if the water must travel across or perpendicular to the direction of bedding."

The cost of construction and subsequent expenses for maintenance are found to be so large that the author expresses the opinion that a pumping plant consisting of a Corliss condensing engine and centrifugal pump would be more satisfactory.

Use of water in agriculture—a contribution to the study of irrigated meadows in the Vosges, M. R. Olry (*Ann. Inst. Nat. Agron., 2. ser., 5 (1906), No. 1, pp. 233–382*).—A thorough study of a system of agriculture in the department of Vosges, France, corresponding more or less closely with that found on certain elevated plateaus of the western United States.

The systems of water distribution described are similar to those existing in many western States, and the same confusion and difficulty is experienced in the strict enforcement of priorities in times of drought, to remedy which the writer recommends irrigation associations between whom agreements shall be made to use water in turn for a period of 5 days each.

With regard to the quantity of water used the author finds that "In the great majority of cases the quantity of water used in the districts studied varies between 150,000 and 300,000 cubic meters per hectare per year (sufficient to cover soil to a depth of from 50 to 100 ft.). The amount diverted by the canals amounts usually to 100 liters per second per hectare" (1.43 cu. ft. per second per acre).—In commenting upon this apparently exorbitant use of water, the author says:

"Nobody has been able up to the present to stop this harmful practice, for the farmer does not consider it prejudicial to the maintenance of soil fertility, the general idea being that 'too much water can not be used,' yet by following these methods the soluble constituents of the soil disappear, the humus becomes less and less capable of nitrification, the free phosphoric acid is unable to combine with bases and is slowly drained away, lime is dissolved in the presence of the excess of carbonic acid and is likewise lost through drainage."

A sand trap for irrigating ditches, H. O. Crafts (*Engin. Rec., 54 (1906), No. 6, pp. 150, 151*).—Some considerations bearing on the necessity of such devices in the case of canals diverting water from streams carrying large amounts of foreign matter, and a description of a typical sand trap.

The underflow in Arkansas Valley in western Kansas, C. S. Slichter (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 153, pp. 90, pls. 3, figs. 24*).—Investigations on the underflow of the Arkansas River were made during the summer of 1904. The following principal conclusions were reached:

"(1) The underflow of Arkansas River moves at an average rate of 8 ft. per 24 hours, in the general direction of the valley.

"(2) The water plane slopes to the east at the rate of $7\frac{1}{2}$ ft. per mile and toward the river at the rate of 2 to 3 ft. per mile.

"(5) The underflow has its origin in the rainfall on the sand hills south of the river and on the bottom lands and plains north of the river.

"(7) The influence of the floods in the river upon the ground-water level does not extend $\frac{1}{2}$ mile north or south of channel.

"(8) A heavy rain contributes more to the underflow than a flood.

"(9) On the sandy bottom 60 per cent of an ordinary rain reaches the water plane as a permanent contribution.

"(10) The amount of dissolved salts grows less with the depth and with distance from the river channel.

"(11) There is no appreciable run-off in vicinity of Garden, Kans.

"(12) Carefully constructed wells in Arkansas Valley are capable of yielding very large amounts of water. Each square foot of percolating surface of well strainers can be relied upon to yield more than 0.25 gal. of water per minute under 1-ft. head.

"(14) Private pumping plants in the bottom lands will be profitable for irrigation if proper kind of power be used. . . . The present cost of pumping with gasoline for fuel is not encouraging."

The measurements of movement of underflow were made by the electrical method. Ground-water levels were obtained by observing water levels in private and specially sunk wells. Various contour maps of the water plane, cross-sections at various points, and views of cardboard models of changes in water plane at different localities illustrate the report.

Underground water in the valleys of Utah Lake and Jordan River, Utah, G. B. RICHARDSON (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 157, pp. 81, pls. 9, figs. 5*).—This paper "outlines conditions of occurrence of the subterranean waters and describes their development in the valleys of Utah Lake and Jordan River."

Water powers of northern Wisconsin, L. S. SMITH (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 156, pp. 145, pls. 5, figs. 5*).—A study of the water powers of the various drainage systems of northern Wisconsin, includlng for each system information as to its topography and drainage, reservoir sites, and the water powers developed along the different streams.

High-lift turbine pumps; their design and efficiency, R. J. DURLEY (*Engin. Mag., 31 (1906), No. 4, pp. 503–525, figs. 24*).—A review of the work which has been done in the last few years in the application of the centrifugal pump to those high-lift operations where formerly only the reciprocating pump was practicable.

These high-lift centrifugal pumps differ from the usual centrifugal pumps merely in having a ring of guide blades surrounding the impeller. By placing turbine pumps in series so that the first impeller discharges into a space connected with the suction of the second wheel, and so on, a multiple-stage pump is obtained, making it possible to pump against correspondingly greater heads. The usual head for a multiple-stage pump is from 300 to 600 ft., though by putting two or more such pumps in series heads up to 1,500 ft. have been attained.

"The results attained by the modern high-lift centrifugal pump may be stated generally as follows: An efficiency in most cases of 70 to 75 per cent can be obtained, and under suitable conditions, when the relation between head and discharge is most favorable, this may even reach 80 per cent on trial.

"It is probable that further progress will soon enable efficiencies corresponding to those of the best water turbines to be obtained.

"It is worthy of remark that high-lift turbine pumps can maintain their original efficiency much better than is usual with large piston pumps."

A number of examples are cited of successful application of the turbine pump to various purposes, and the article is illustrated by numerous diagrams and half-tones of different types of pumps.

Suction gas producer trials (*Engineer [London], 101 (1906), No. 2635, pp. 659, 660, figs. 10*).—The 20-horsepower plant of the National Gas Company, Ltd., Ashton-under-Lyne, secured the gold medal in the tests conducted under the auspices of the Royal Agricultural Society at Derby.

The main features of this plant consist of a vaporizer surrounding the upper portion of the generator, which can be removed for periodic cleaning when using hard water; and of a device for heating the air previous to its mixture with the steam. The latter device consists of a spiral passageway located in the outlet of the generator. The walls of the passage are highly heated by the outflowing gas, and the air in traversing the passage becomes correspondingly hot, enabling it to carry along the requisite quantity of steam in suspension as it enters the generator. A hand-operated fan is also provided to facilitate starting. The gases are cleaned and cooled by being passed through an ordinary coke scrubber, after which they pass directly to the engine.

Test of producer gas engine plant at Toledo, Ohio (*Gas Engine, 8 (1906), No. 8, pp. 254–256*).—Report of a test of gas engine and producer plant of American design and manufacture. On test the fuel consumption was 0.84 lb. of Pennsylvania pea anthracite coal per brake-horsepower hour, thus giving a thermal efficiency of about 24 per cent. The same plant now in commercial operation uses 1.14 lbs. of coal per brake-horsepower per hour. The efficiency of the producer alone was found to be about 93 per cent.

The use of alcohol as a fuel for gas engines, H. DIEDERICKS (*Internat. Mar. Engin., 1906, pp. 263–270*).—In this article the author gives a very complete résumé of the whole subject, his information being drawn largely from German practice. He considers the fuel value and physical properties of alcohol, and the details of the alcohol engine wherever they may be different from a gasoline or crude-oil engine.

In the discussion of denaturizing agents for ethyl alcohol the following table is given, showing the materials and their percentages as used in different countries:

Denaturizing agents used in different countries.

Country.	Specific gravity of denaturized alcohol at 15° C.	Methylene (wood alcohol) and its impurities.	Pyridine or pyridine bases.	Acetone.	Benzol.	Benzine.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
France	0.832	7.5	....	2.5	....	0.5
Germany:						
Denaturized alcohol	.819	1.5	0.5	.5	....	....
Motor alcohol	.825	.75	.25	.25	2.0	....
Austria:						
Denaturized alcohol	.835	3.75	.5	1.25	....	....
Motor alcohol	.826	.5	Trace.	Trace.	2.5	....
Russia	.836	10.0	.5	5.0	....	....
Italy—Motor alcohol	.835	6.5	.65	2.0	1.0	....
Switzerland	.837	5.0	.32	2.2	....	....

With regard to benzol the author states that "from 10 to 40 per cent is sometimes employed, thus raising the heating value of the fuel and thus decreasing the cost per heat unit." As to the rusting of the engine cylinder by the use of alcohol, it is claimed that this may be obviated by greater care in securing a proper mixture of air and alcohol and by using benzol as an additional safeguard. Several types of alcohol carbureters are illustrated and described, and attention is called to the fact that a high degree of heating in the carbureter is undesirable from the standpoint of capacity and because of danger of preignition. The best temperature for the carbureter is shown to be between 75 and 80° F.

In discussing the efficiency and cost of operation of engines using different explosive fuels, the author brings out certain facts not generally recognized.

Assuming that alcohol can be put on the market at the same price as gasoline, he is able to compute the heat cost, as shown in the following table:

Relative heat cost of alcohol, gasoline, and kerosene.

Fuel.	Heating value per pound	Cost per— Gallon.	Cost per— Pound.	Specific gravity.	Cost of 10,000 B. T. U.
	B. T. U.	*Cents.*	*Cents.*		*Cents.*
Gasoline	19,000	15.0	2.57	0.710	1.35
Kerosene	18,500	13.0	1.88	.800	1.02
Alcohol, 90 per cent	10,080	15.0	2.21	.815	2.19

From German tests the following table of economy and cost figures is collated:

Relative economy of alcohol, etc. (German data).

Fuel.	Cost for 10,000 B. T. U.	Best consumption of fuel per B. H. P. hour.	Best thermal brake efficiency.	B. T. U. per B. H. P. hour.	Fuel cost per B. H. P. hour.
	Cents.	*Pound.*	*Per cent.*		*Cents.*
Gasoline	1.35	0.580	23.0	11,000	1.485
Kerosene	1.02	.725	18.0	14,140	1.442
Alcohol, 90 per cent	2.19	.803	31.7	8,030	1.758

From these figures the author concludes that at the present time, with 90 per cent alcohol at 15 cts., the operation with alcohol would cost about 19 per cent more than with gasoline and about 22 per cent more than with kerosene. The advantage of gasoline from the standpoint of fuel cost is, however, said to be less than the other advantages in favor of the alcohol engine, which accounts for its extended application in European countries.

Free alcohol in the arts and as fuel, C. Baskerville (*Amer. Mo. Rev. of Reviews, 34 (1906), No. 199, pp. 211–214*).—A brief discussion of the uses of alcohol, its manufacture and denaturization, with certain economic and social conditions likely to result from the removal of the tax upon the denaturized product.

The alcohol law and its relation to American industry, D. A. Willey (*Tradesman, 55 (1906), No. 9, p. 51*).—The writer reviews the status of the alcohol industry in France and Germany and makes some predictions as to its future in this country under the "alcohol law."

It is held that alcohol can be distilled from corn at a total expense of less than 12 cts. per gallon, and from refuse of molasses, beets, and sugar cane at about 10 cts. per gallon. As an instance of the industrial development which will result from the use of grain alcohol, the author mentions one large implement firm which has enlarged its plant purposely for making gas engines so that it will be able to build no less than 20,000 a year. "The indications are that fuel stations for distributing alcohol will be located throughout the United States, just as petroleum tanks are now situated." The writer thinks "the advantages to the South and West from the use of alcohol are especially notable, since these sections produce such an enormous quantity of corn, potatoes, and beets, together with refuse molasses from sugar manufacture."

Firing boilers with vegetable fuels, M. Ringelmann (*Jour. Agr. Prat., n. ser., 12 (1906), No. 28, pp. 46–50*).—In this article means are described for utilizing as a fuel peat, wood, tree branches, bark, sawdust, dry weeds, straw, sugar-cane stalks, etc. The quantities of each necessary per horsepower hour are given, and special types of furnaces adapted for such fuels are illustrated and described.

Science in thrashing, C. F. CONNER (*St. Joseph, Mich.: The Threshermen's Review Co., 1906, pp. 174, figs. 20*).—In this work the author treats of the operation, management, and care of thrashing machinery. In the first portion of the book the various parts of the thrasher are described and their functions explained. Numerous practical suggestions as to adjustments and management are given.

In part 2 traction and portable engines are considered, some thermodynamic theory being included, together with explanations of the action and advice as to the care of various engine and boiler appliances.

Refrigerating apparatus, H. PILLAUD (*Rev. Hort. [Paris], 78 (1906), No. 15, pp. 355–358*).—In this article is noted the increasing application of cold storage for the preservation of fruits and vegetables as well as bulbs and flowers. Various machines exhibited at the last agricultural show at Paris are described. Some of these machines are intended for hand power, the capacity being about 1,300 gm. of ice per hour. The various refrigerating mediums used in the machines exhibited were ammonia, carbonic acid, sulphur dioxid, and methylated chlorin.

RURAL ECONOMICS.

How to choose a farm, T. F. HUNT (*New York: The Macmillan Co., 1906, pp. XVIII+412, figs. 133*).—"In this book the attempt has been made to state the principles concerned in the selection of a farm, and then to apply these principles to a discussion of the different regions of the Western Continent."

The author regards farming as a business, and treats the selection, arrangement, and management of a farm from the standpoint of making a profit. To this end fertility of soil, topography, nearness of location to market, and transportation facilities for the products of the farm are important factors in selecting farm property. "The local market is often of considerable advantage for the sale of the minor products of the farm, even when the major products are shipped to a distant market."

The United States is divided by the author into geographical divisions which practically conform in nature of soil, climate, and suitability of crops. Methods of cultivation adapted to each region are given, as well as plans and illustrations of typical farms in these different sections, in the outlying possessions of the United States, and in other countries in North and South America.

An appendix contains information about securing title to public lands in the United States and Canada, various agricultural statistics, and an extended bibliography.

The marketing of Irish produce (*Dept. Agr. and Tech. Instr. Ireland Jour., 6 (1906), No. 4, pp. 662–675*).—Based upon information secured from a large number of wholesale buyers of Irish agricultural produce, attention is called to the defects in present methods of grading and packing eggs, crammed poultry, and fruits. Suggestions are made to Irish producers and shippers for improving present methods of marketing these and similar goods with a view to more successfully meeting foreign competition in London and other British markets.

The economic future of the negro—the factor of white competition, W. E. B. DUBOIS and A. H. STONE (*Pubs. Amer. Econ. Assoc., 3. ser., 7 (1906), No. 1, pp. 219–294*).—This is the subject of 2 papers read at the eighteenth annual meeting of the American Economic Association held at Baltimore, Md., December 27–29, 1905.

Statistics are given which show that white farm laborers and particularly Italian immigrants are slowly displacing the colored race in the South along the line of agricultural pursuits. It is believed, nevertheless, that "the home of the masses of the [colored] race must remain in the Southern States, and that their destiny must be worked out upon the soil." Better educational and agri-

cultural systems, the privilege of acquiring land, justice in executing wage and land tenure contracts, cultivation of food supplies in addition to cotton, and intensive culture are urged as means of raising the million and a half of colored farmers and farm laborers to a position of economic equality with their white competitors.

The packers, the private car lines, and the people, J. O. ARMOUR (*Philadelphia: Henry Altemus Co., 1906, pp. XIV + 15–380*).—The author treats of the origin and development of the refrigerator-car service, and gives statistics to show to what extent this means of transportation has been instrumental in developing the cattle, fruit, vegetable, and other rural industries throughout the United States. The advantages of this service in supplying fresh agricultural products at all seasons of the year and at reasonable prices to distant urban populations are also indicated.

Yearbook of world economics, R. CALWER (*Jahrbuch der Weltwirtschaft. Jena: Gustav Fischer, 1906, pp. VI + 281*).—In this publication statistical data relating to labor, agriculture, mining, iron and textile manufactures, finance, etc., for the year 1904, in comparison with preceding years, are reported.

The chapter on agriculture is mainly devoted to the world's production of wheat, rye, barley, oats, and corn. The acreage devoted to the growth of these crops in the main cereal-growing countries is indicated, together with the prices per ton in the principal markets of the world. Statistics are given which show that there was a gradual increase in cereal yield from 1878 to 1904.

Foreign live stock and dead meat imports into the United Kingdom (*Dept. Agr. and Tech. Instr. Ireland Jour., 6 (1906), No. 4, pp. 700–708, dgms. 7*).—Comparative statistics of the impo ts of live stock and meats into Great Britain from Ireland and foreign and colonial countries for the years 1885 to 1905, inclusive, are reported and discussed.

The highest total value of live stock imported from foreign and colonial countries was recorded in 1897, amounting to £11,380,492. Since then the live stock import trade has slowly declined, particularly with pigs and sheep. The import of live cattle from foreign countries, however, has not changed much from year to year. In 1905 the returns show the number of cattle imported from foreign countries to be 565,139, valued at £9,665,806, as compared with 749,131 imported from Ireland.

As regards the importation of fresh meat into the United Kingdom, there has been a steady increase of value from £4,016,684 in 1885 to £17,430,443 in 1905. Nine-tenths of the fresh beef imported comes from the United States and Argentina, but the latter is slowly taking the lead in this branch of British trade as shown by the following figures:

Imports of fresh beef into the United Kingdom.

Imported from the—	In 1904.	In 1905.	In 1906 (six months).
	Cwt.	*Cwt.*	*Cwt.*
United States	2,395,836	2,232,206	1,228,743
Argentina	1,675,271	2,580,152	1,517,103

"The prices realized, however, by Argentine beef remain considerably lower than those obtained by the fresh beef from the United States," while home-grown and Irish prime beef maintains a clear lead over all in market prices.

The attention of the Irish farmer is called to the fact that the imports of foreign and colonial meat have been increasing more rapidly than any other agricultural import which competes with home produce. This, it is claimed, "points to the fact that Ireland must depend on a diversified agriculture and that she must produce fresh supplies of the best quality in every line."

Cotton: Its cultivation, marketing, manufacture, and the problems of the cotton world, C. W. BURKETT and C. H. POE (*New York: Doubleday, Page & Co., 1906, pp. XII + 331, pls. 58, figs. 4*).—A popular discussion of the subject of cotton, in all its economic aspects, from the preparation of the land to the final disposition of manufactured cotton fabrics. The authors point out the possibilities of the South to provide the world's chief markets not only with raw cotton, but with manufactured cotton goods and cotton-seed by-products. The value and importance of the cotton crop to the future agricultural and economic development of the South is especially emphasized.

MISCELLANEOUS.

Annual Report of Nevada Station, 1905 (*Nevada Sta. Rpt. 1905, pp. 45*).—This contains reports of the director and heads of departments. The director discusses reclamation and irrigation work in Nevada, farmers' institutes, etc., and gives a financial statement for the fiscal year ended June 30, 1905. The departmental reports contain notes on forage plants, orchard, and small fruits; spraying for the San José scale; meteorological conditions; experiments with field crops, etc.

Seventeenth Annual Report of South Carolina Station, 1904 (*South Carolina Sta. Rpt. 1904, pp. 26*).—This contains the organization list of the station, a financial statement for the fiscal year ended June 30, 1904, and reports of the vice-director and members of the station staff on the different lines of work during the year. The report of the chemist contains averages of analyses of different classes of fertilizers from 1891 to 1904.

Eighteenth Annual Report of Tennessee Station, 1905 (*Tennessee Sta. Rpt. 1905, pp. 47–63*).—This contains the organization list of the station, reports of the director and members of the station staff, and a financial statement for the fiscal year ended June 30, 1905. A preliminary note on clover diseases in Tennessee has been abstracted from another source (E. S. R., 17, p. 567).

Experiment Station Work, XXXV (*U. S. Dept. Agr., Farmers' Bul. 259, pp. 32, figs. 3*).—This number contains articles on the following subjects: Use of commercial fertilizers, weight of lime per bushel, spreading lime, soil sterilization, weights per bushel of seeds, disease resistant crops, corn billbugs and root-louse, asparagus rust and its control, alfalfa meal as a feeding stuff, singed cacti as forage, cattle feeding in the South, milk fever, nail wounds in horses' feet, and use of a cheap canning outfit.

Press Bulletins Nos. 125–151 (*Kansas Sta. Bul. 136, pp. 143–206, fig. 1*).—Reprints of press bulletins on the following subjects: Meadow fescue, corn ensilage for steers, rabies or hydrophobia, preventive work against the Hessian fly, *Bromus inermis*, poison for prairie dogs and other rodents, warbles or grubs in cattle, the common garden mole, grasshopper poisons, baby beef, ringbone and spavin, contagious abortion in cattle, some troubles of swine, testing seed corn for vitality, garget (congestion of the udder), Kansas Experiment Station egg-laying contests, swine feeding test with sorghum-seed meal, Kafir-corn meal, soy-bean meal, and corn meal, summer pruning, preparing fruits for exhibition, the garden webworm, a shade-tree pest (the fall webworm), testing winter wheat varieties for western Kansas, a troublesome parasite of the horse, swine feeding tests (Armour's deodorized meat meal and alfalfa hay as supplementary feeds to corn), the San José scale in Kansas, and baby beef production with western feeds.

Bulletins of Alabama College Station (*Alabama College Sta. Index to Vol. XII, Buls. 127–129, and Ann. Rpt. 1904, pp. 105–112; Vol. XIII, Buls. 130–134, and Ann. Rpt. 1905, pp. 205–214*).

NOTES.

Alabama College Station.—C. S. Waldrop has been appointed assistant chemist.

Arkansas University and Station.—Hon. C. C. Hamby, of Prescott, has been appointed a member of the board of trustees of the university, to succeed Hon. Dougald McMillan, resigned. The work of tick eradication in the northern part of the State has been begun by a preliminary survey of Benton and Washington counties. Dr. W. Lenton, recently appointed instructor in veterinary science and veterinarian to the station, will have charge of the work, in cooperation with the Bureau of Animal Industry of this Department. C. H. Tourgee, whose resignation from the Oklahoma College and Station was previously noted, has been appointed in the dairy department of the Arkansas Station.

Colorado College and Station.—H. M. Cottrell, formerly of the Kansas College and Station, has been appointed professor of animal husbandry, vice J. A. McLean, who, as previously noted, has gone to the Iowa College. L. F. Paull, formerly of the Kansas Station and for the last year a graduate student at Cornell University, has, according to *Cornell Countryman*, been appointed assistant horticulturist at the Colorado Station.

Georgia Station.—At a recent meeting of the governing board, the resignation of R. J. Redding as director was accepted, and Martin V. Calvin, of Augusta, Ga., secretary of the State Agricultural Society, was elected to succeed him. J. M. Kimbrough, agriculturist, was elected vice-director.

Illinois Station.—A. N. Gregory and N. E. Bell, graduates in chemistry of the North Carolina College, have been appointed as analytical chemists to succeed W. F. Pate, who, as previously noted, has gone to the Ohio Station, and C. E. Leighty, who has accepted a position with the Bureau of Plant Industry of this Department. W. G. Eckhardt has been appointed assistant in soil fertility.

Kansas College and Station.—The new horticultural building is nearing completion. The greenhouses are to be replaced by a large modern structure this winter. The station has leased 40 acres of farm land just outside the city for experiments in dry farming.

Kentucky Station.—E. S. Good, formerly connected with the Illinois University and Station, has accepted a position in animal husbandry at the station.

Louisiana Stations.—E. Rosenthal, dairyman at the Calhoun Station, has resigned.

Massachusetts College and Station.—The formal inauguration of Kenyon L. Butterfield as president of the college took place October 17. Among the institutions represented at the exercises were the agricultural colleges of Connecticut, Michigan and Rhode Island, Boston, Clark and Maine universities, Amherst, Mt. Holyoke, Simmons and Smith colleges, the Case School of Applied Science, and the Massachusetts Institute of Technology. In an introductory address M. F. Dickinson, for the board of trustees, paid a glowing tribute to the late President Goodell. The subject of the inaugural address of President Butterfield was The Forward Movement in Agricultural Education. In this he outlined the directions along which progress is making, the special mission

and opportunities of the college, and a program for strengthening its work and developing its field of usefulness. H. A. Parsons has been appointed dairy tester, vice J. G. Cook, resigned. F. G. Hellyar, inspector in the division of foods and feeding, has resigned to accept a position as assistant in the agricultural department at Mount Hermon School.

Michigan College.—A department of farm mechanics has been established and placed under the direction of L. J. Smith, a graduate of the engineering course at this college in 1906.

Missouri University and Station.—Among the recent appointments are the following: Miss Edna D. Day, Ph. D., of the University of Chicago, as assistant professor of household economics; L. F. Childers, of the University of Missouri, as assistant in agronomy; E. A. Trowbridge, as assistant in animal husbandry, and W. H. Chandler, of the University of Missouri, as assistant in horticulture. H. S. Wayman has been promoted from assistant in dairy husbandry to instructor in the same subject. B. M. Duggar, botanist, and W. L. Howard, assistant horticulturist, have returned from a year's leave of absence in Europe.

Nebraska University and Station.—Roscoe H. Shaw, assistant professor of agricultural chemistry in the university and associate chemist in the station, has resigned to become assistant professor of dairy husbandry in the University of Missouri. He is also connected with the Dairy Division of this Department as dairy expert.

Cornell University.—L. B. Judson, of the Idaho College and Station, has been appointed assistant professor of horticulture. The new buildings of the college of agriculture are approaching completion, and it is expected will be ready for occupancy this fall. A model schoolhouse is being erected as a part of the extension work. In addition to the usual recitation room, it will contain a large laboratory for nature study. An effort will be made to secure its duplication at many places in the State.

North Carolina College and Station.—J. G. Hall, who has been taking advanced work at Harvard University, has recently been added to the station staff as assistant pathologist. W. A. Syme, Ph. D., a graduate of the college and of Johns Hopkins University, has been appointed assistant chemist in the station and instructor in the college, and J. C. Temple has been appointed assistant in bacteriological work in the college and station. He will give his attention especially to work in connection with soils. Robert S. Curtis, a graduate of the Iowa Agricultural College, has become assistant in animal husbandry in the college and station.

Porto Rico Station.—D. W. May, director of the station, has returned for a short visit, and will attend the convention of the Association of American Agricultural Colleges and Experiment Stations at Baton Rouge. Pineapple plants sent up from the station last spring and planted outdoors at the Arlington Farm of this Department produced fruit which was of good flavor and well matured by the first of October.

South Dakota Station.—The station plans to erect a building to be used by the veterinarian in investigating diseases of farm animals, at a cost of about $2,000.

West Virginia University and Station.—T. C. Johnson has been placed in charge of the botanical work of the university and is no longer connected with the station. E. B. Copeland, who has been connected with the government laboratories at Manila, has been elected horticulturist of the station and will enter on his work about the middle of November. He is a graduate of Leland Stanford University, and previous to going to Manila occupied the chair of botany in this university.

Wisconsin University and Station.—Andrew McLeod has been appointed instructor in soils in the university and assistant in soils in the station. Conrad Hoffmann has become assistant in agriculture and bacteriology and Christ

Schroeder assistant in animal husbandry in the university and station, and E. J. Delwiche superintendent of the Northern Wisconsin substations.

State Experimental Farm in Brazil.—The following facts concerning the Fazenda Modelo, at Piracicaba, Brazil, are furnished by its director, J. William Hart, formerly of the University of Illinois:

The Fazenda has an area of 319.12 hectares (about 788 acres). About 50 hectares are under cultivation, and the remainder is pasture and second-growth timber. The principal crops are corn, rice, beans, sugar cane, and cotton. Many variety tests are carried on. One field of corn from selected seed yielded at the rate of 60 bu. per acre. Florida velvet beans, planted in corn at the last cultivation, grew vigorously, and the roots were found to be covered with nodules. Plat tests with alfalfa and California burr clover indicate no advantage from liming, and that phosphoric acid is most needed. Alfalfa grown under irrigation has given good yields, and garden vegetables are being grown in contour checks and depressed beds. If this proves practicable a profitable field will be opened, as during the dry season from June to November the markets are almost bare of green vegetables. It is also hoped that by means of irrigation the planting of rice may be deferred so that the crop will mature two months later than at present. In this way dry, sunny weather will be insured for harvesting and thrashing.

A plantation of 9,000 coffee trees and a vineyard of 400 grapevines have been planted on newly cleared land. Over 100,000 seedling oranges and lemons are in nursery rows, ready to be budded. George Weigt, a graduate of the Royal Gardens, Kew, England, is horticulturist and pomologist.

The students of the Louis Queiros School of Agriculture receive instruction in modern agricultural methods. At present 47 are in attendance. The Fazenda is equipped with the latest and best American machinery. The cattle and hogs are mostly native blood, but improvement is being sought through importations from Europe.

The State of São Paulo appropriates about $25,000 a year for the maintenance of the Fazenda, besides special appropriations for the erection of buildings.

New Experiment Stations in Madras.—The Madras Department of Agriculture has arranged to start a new experiment station at Attur, in the Chingleput district, and another at Nandyal, in the Kurnool district. The former will be devoted to the thorough trial of perennial and exotic cottons under irrigation and to the growth of fodder crops, and the latter is to be devoted mainly to the study of the varieties of cotton known as "Northerns" and their improvement by selection and crossbreeding. A study of the sorghum crop of the Nandyal Valley will also be made.

Chinese Experimental Field.—The Chinese Government has approved a request made by the native board of commerce at Peking for the use of the Loshan garden, which is situated on the Imperial Road outside of the Hsichih Gate of Peking, with an area of 166⅔ acres, as a field for agricultural experiments. In 1905 the board was authorized to take measures for the encouragement of agriculture, but up to the present, with the exception of the few experimental fields and agricultural schools established in Chihli, Shantung, Shansi, Honan, and Fukień, little has been done along this line.

Agricultural Investigation for Tropical Agriculture.—At the York meeting of the British Association the past summer Prof. Wyndham Dunstan, in his opening address to the section of chemistry, speaking of some of the opportunities afforded to applied chemistry in the field of agriculture, said:

"If we are to compete successfully with foreign countries, it is necessary that the position of science in relation to tropical agriculture should be definitely

recognized. The days when a botanical garden served the purpose of an entire scientific establishment in a colony have passed away, and we now require, in order that a proper return should be obtained and the natives assisted in their agricultural practice, a scientific department with a proper complement of specially trained officers, including a consulting chemist, other specialists being added to the staff as the requirements arise. These officers should be remunerated on a scale likely to attract some of the best educated men from this country, which is at present far from being the case."

Macdonald College.—Sir William Macdonald, who established the institution at St. Anne de Bellevue, has deeded the property to McGill University and provided an endowment of $2,000,000, besides the plant. A main building, buildings for agriculture and horticulture, for chemistry and physics, for biology and bacteriology, are in process of construction, together with a boys' and a girls' building, a horticultural barn, and a power house.

All of the buildings are substantially built of brick, iron, and concrete, with partitions of fireproof hollow tile and floors of concrete with wood laid on top in certain of the rooms. The walls are lined inside with hollow tiles, so as to give a dead air space. The construction is very thorough in every respect. The buildings are to be heated from a central heating plant, with a comprehensive ventilating system. Several of them are connected by underground passages, to be used in bad weather. It is expected that the buildings will be ready for occupancy in the fall of 1907. They will provide accommodations for about 400 pupils—175 men and 225 women. The school has a farm of about 560 acres, a part of which is in cultivation. One of the farms purchased was provided with large barns for cattle, and considerable stock is being kept there. The college will have a large poultry plant and extensive rooms for showing agricultural machinery.

In addition to training boys and girls for farm life, a regular normal department will be conducted for the training of teachers, with a special view to providing persons suited to teaching elementary agriculture, nature study, and the like. Although affiliated with McGill University, the faculty of the college will dictate as to the courses except such as lead to degrees.

Elementary Agricultural Education.—The Morgan Township High School, located at Okeana, Butler County, Ohio, has introduced elementary agriculture, and a class of 9 students is taking the work this year. There is also in the school an agricultural club, organized under the direction of the Ohio State University.

The committee on education of the Ohio State Grange has undertaken an active campaign for the study of agriculture and domestic science in the subordinate granges of the State, under the direction of the college of agriculture and domestic science of the Ohio State University. The committee having this work in charge has issued a number of educational circulars and two bulletins, one setting forth the objects of the work and giving an outline of a course of study and reading on the soil and its management, and the other an outline and course of study on farm crops and gardening.

The college of agriculture of Illinois University has added an instructor this year for the purpose of preparing prospective teachers of agriculture and to determine what phases of agriculture seem best adapted for introduction into public schools. A small class of college students has taken up this work.

The County Superintendents' Association of Indiana has forwarded to Purdue University a formal request to organize a training school for teachers in agriculture and nature study.

The *Oklahoma School Herald* is running a department of agriculture, edited by E. E. Balcomb, teacher of agriculture in the Southwestern Normal School.

Agricultural Instruction in Ireland.—According to the Annual Report of the Department of Agriculture and Technical Instruction for Ireland, 1904–5, agricultural instruction was continued at the Royal College of Science, Dublin, the Albert Agricultural College, Glasnevin, and at Munster Institute, Cork. At the Royal College of Science 38 students were in attendance, at the Albert Agricultural College 68, and at Munster Institute 50, the latter all young women. The courses in dairying, calf rearing, poultry keeping, gardening, sewing, cooking, and laundry work at the Munster Institute are so highly appreciated that although only 50 students can be admitted, there were at the time of this report nearly 250 applicants on the waiting list of the department.

Winter agricultural schools, running from six to twenty-six weeks, were held at 16 centers and 317 students were enrolled. Twenty itinerant instructors were at work during the year and attended a total of 1,054 meetings of farmers. A large number would have been employed but for the difficulty of securing men of adequate training and experience. To overcome this difficulty somewhat the department held a forestry school for instructors in agriculture at Avondale Forestry Station, a poultry-fattening school at Avondale Poultry Station, and a bee-keeping school at Albert Agricultural College.

Reclamation of the Rann of Cutch in India.—The following concerning this great reclamation enterprise is quoted from *Science:* "According to Reuter's Agency, the Indian government has under consideration a scheme for reclaiming the Rann of Cutch, a work which, if carried out, will be similar to that undertaken by the Dutch in the Zuider Zee. The Rann of Cutch is a waste, at some seasons water, at others land, and it is proposed to reclaim it by closing the inlets from the sea, which are narrow. The water, which is everywhere shallow, would then evaporate rapidly, leaving heavy saline deposits. These, it is thought, could be washed out and drained away by a great canal to be constructed from the Indus. The application of scientific agriculture to the reclaimed land and the construction of a railway linking Karachi and Bombay would complete the proposed scheme."

International Conference on Hybridization and Plant Breeding.—At the concluding meeting of this conference, according to a note in *Nature*, Veitch gold memorial medals were presented to W. Bateson, F. R. S., the president of the conference, Professor Johannsen, Professor Wittmack, and Prof. Maurice de Vilmorin, and silver-gilt Banksian medals to Miss E. R. Saunders, lecturer on botany at Newnham College, and R. H. Biffen, for eminent services rendered to scientific and practical horticulture. Professor de Vilmorin, as the representative of the Horticultural Society and the Botanical Society of France, invited the society to hold its next conference at Paris.

During the conference the following resolution was adopted: "That the members of the International Conference on Hybridization and Plant Breeding, gathered from all parts of the world and assembled in the Hall of the Royal Horticultural Society of Great Britain, desire to express to the President of the United States of America and to the Minister of the Department of Agriculture at Washington their hearty appreciation of and thanks for the invaluable assistance which has been given to farmers, horticulturists, planters, and scientific men throughout the whole world by the liberal distribution of American research publications."

Jubilee Horticultural Exposition.—An international art and horticultural exposition is to be held at Mannheim, Germany, during the growing season of 1907. Eight special exhibits are to be made on different dates, six of which will be international in character. The first of the international exhibits will be held May 18–21, at which forced fruits and vegetables, including asparagus, will be the special features. A second exhibit will be held June 8–11, with straw-

berries, early cherries, stone fruits, and early vegetables as the leading features. A special cherry exhibit on June 22–25 will be confined to German productions. On July 13–15 an international exhibit of early fruits and vegetables will be made, on August 10–12 of early pome and drupaceous fruits, on September 21–24 of fall vegetables, and on October 5–14 a general exhibit of fruits.

An Abstract Journal for Tuberculosis.—The literature relating to tuberculosis of man and animals has become so extensive and is published in such a great variety of journals, some of which are mainly devoted to other matters than medicine, that it is almost impossible to obtain abstracts even of the most important articles without consulting a long list of journals. To supply this apparent bibliographical deficiency a new abstract journal has been established, *Internationales Centralblatt für die gesammte Tuberkulose-Literatur*, the object of which is to contain as complete a list of references as possible to the literature in the whole field of tuberculosis.

Miscellaneous.—It is learned from *Nature* that Maj. P. G. Craigie, assistant secretary of the British Board of Agriculture and Fisheries, and known to many through his visit to the American stations, has retired. He is succeeded by Mr. Henry Rew.

Dr. Otto Müller, of Konigsberg, has been appointed director of the Bacteriological Institute of the East Prussian Chamber of Agriculture, which opened October 1, 1906.

The American Breeders' Association will hold its regular winter meeting at Columbus, Ohio, January 15–18, 1907. The sessions will be held at the university and board of trade buildings. The association now has an annual membership of over 950, with 42 life members. Its second annual report has just been issued.

A New England conference on rural progress is to be held in Boston next March, under the auspices of the Massachusetts State Board of Agriculture.

A farmers' reading course in practical agriculture for the farmers of South Africa is to be given under the supervision of William P. Brooks, director of the Massachusetts Station. The course will be covered in Brooks' Agriculture, Vols. I and II, and the student will be guided in his studies by a large syllabus of over 60 pages, containing lesson assignments, helpful suggestions, directions for experiments, and over 2,000 questions on the lessons.

At the opening of the session of the Southeastern Agricultural College at Wye, October 1, Dr. Henry E. Armstrong delivered the inaugural address. A conference of fruit growers was held at the college October 22, with discussions upon methods of planting, fungus diseases, insect attacks, and strawberry culture, by S. U. Pickering, E. C. Salmon, F. V. Theobald, and W. P. Wright. Registration for the conference was in advance.

The Queensland Department of Agriculture has inaugurated a system whereby young men who find it impractical to attend the Agricultural College at Gatton are given the opportunity of gaining an insight into farming at the Hermitage State Farm, Warwick.

The department of agriculture of India has begun the publication of a series of memoirs, which deal with scientific subjects relating to agriculture. These memoirs will be published in separate series, designated as Chemical Series, Botanical Series, Entomological Series, etc., and will appear as material is available for publication. Up to July, 1906, three numbers had appeared in the Botanical Series—The Haustoria of the Sandalwood, Indian Wheat Rusts, and Fungus Diseases of Sugar Cane in Bengal. In the Chemical Series, one number has been issued on the composition of Indian Rain and Dew, and in the Entomological Series one number, The Bombay Locust.

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EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, Ph. D., *Assistant Director*

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EXPERIMENT STATION RECORD.

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The dedication of the new buildings for the Harvard Medical School has attracted much attention, as marking in a high degree the development of instruction and research in medicine. Some of the addresses on that occasion might be applied with almost equal force to agriculture, and they are of broad interest as indicating advanced thought upon the relation of science to an important branch of practice.

President Eliot and Dr. W. H. Welch both laid great stress upon research as the fundamental basis for advancement in medicine and the importance of the laboratory as marking the highest stage of development to that end. They showed how medicine has progressed step by step with the development of science, and how the great epochs in its progress were attributable to new discoveries and deductions. "The great lesson taught by the history of this development of medicine through the centuries," Doctor Welch said, "has been the unconditional reverence for facts revealed by observation, experiment, and just inference, as contrasted with the sterility of mere speculation and reliance upon transmitted authority. The great epochs of this history have been characterized by some great discovery, by the introduction of some new method, or by the appearance of some man of genius to push investigation and scientific inference to limits not attainable by ordinary minds."

The development of laboratories was described as at once the cause and the result of such progress. "By teaching and exemplifying the only fruitful method of advancing natural knowledge laboratories have overthrown the dominance of authority and dogma and speculation;" and they have demonstrated that "the only abiding, living knowledge, powerful for right action, comes from intimate, personal contact with the objects of study." They have been one of the great factors in advancing research and have resulted in making our knowledge more exact. The laboratory method is now the accepted one in research in natural science.

Doctor Eliot pointed out the broad relations of investigation in various branches of science to the progress of medicine. "The most promising medical research of our day," he said, "makes use of bio-

logical, chemical, and physical science combined. Physiology advances by making applications of the principles, the methods, and the implements of all three sciences. . . . The world has observed, and will not forget, that some of the greatest contributors to the progress of medicine and surgery during the past thirty years have been not physicians, but naturalists and chemists. Pasteur was a chemist; Cohn, the teacher of Koch, a botanist, and Metchnikoff a zoologist. Students of disease must therefore be competent to utilize in their great task every aid which natural science can furnish. How vastly is the range of medical science and medical education broadened by this plain necessity! The dignity and serviceableness of the medical profession are heightened by every new demand on the intelligence and devotion of its members."

This thought was also voiced by Doctor Welch, who declared the subject-matter of medical study to be "complex and difficult far beyond that of any other natural or physical science." He advocated specialization as a great instrument of progress, for, although the various branches of medical science are interdependent, each has its own problems and methods, and "each is most fruitfully cultivated for its own sake by those specially trained for the work. . . . But the further division of labor is carried the more necessary does it become to emphasize essential unity of purpose and to secure coordination and cordial cooperation of allied sciences."

In the creative work of research and investigation the genius and ability of the man were placed above all else. Important as are the most ample and freely available facilities for productive research, "men count for more than stately edifice and all the pride and pomp of outward life. Research is not to be bought in the market place, nor does it follow the commercial law of supply and demand. The multitude can acquire knowledge; many there are who can impart it skillfully; smaller, but still considerable, is the number of those who can add new facts to the store of knowledge, but rare indeed are the thinkers, born with the genius for discovery and with the gift of the scientific imagination, to interpret in broad generalizations and laws the phenomena of nature. These last are the glory of a university. Search for them far and wide beyond college gate and city wall, and when found cherish them as a possession beyond all price."

The analogy between medicine and agriculture is not far to seek. This is especially the case when they are considered from the standpoint of their scientific development and their broad relationships. They have many points of similarity, and hence the lesson of the one may be applicable to the other.

The scientific aspects of both agriculture and medicine present very complex problems, those of the former quite as much as Doctor

Welch ascribed to medicine. Both rest upon the application of principles developed by various branches of science, and these principles and applications arranged and correlated form in each case a composite science. Thus complex relations and the necessity which they impose of utilizing the teachings of all natural science broaden agriculture and medicine alike and heighten the dignity of their practice.

The practice of agriculture, like that of medicine, depends upon the accumulation of experience and investigation and requires much judgment in the interpretation of observed results and their application. Until comparatively recent years the methods of practice were very largely dependent upon the accumulated observations and experiences of practical men. Hence the knowledge was largely empirical and was often without scientific foundation. The deductions upon which it was based were made without an understanding of the reason and causes of what was observed, and too broad generalizations and applications were made. These gradually became traditions of practice and had much the strength of scientific laws. A certain amount of mystery surrounded the practice of medicine, and this was also true of agriculture, especially the ability to produce certain results. Success was attributed largely to the skill of the individual, and it was intimated that the operations of neither were governed by the laws of science.

Gradually these ideas have been dispelled in the case of both medicine and agriculture, and this has come about in both cases as a result of progress in science and the development of methods of research. Progress in recent years has been rapid, and the application and reliability of the results in practice have become fully recognized. As a complex medical science has gradually been developed out of the teachings of investigations in chemistry, physics, and biology, which has prepared the way for intelligent practice in the prevention and combating of disease, so an equally complex science of agriculture is rapidly developing, which enables the art to break away from tradition and places it upon a more enlightened and intelligent basis.

The most noteworthy progress in medicine has come from fundamental investigation which disclosed the reason for observed results, taught the fundamental causes of disease, and has enabled the prevention as well as the intelligent treatment of the disease after it appeared. In agriculture, likewise, some of the most abiding and far-reaching results of research have come from that which was fundamental in the sense of broadening our definite knowledge of the relations and the intermediate steps between cause and effect, enabling the agriculturist to more largely control conditions instead of being at their mercy.

The same danger of reasoning and generalizing from empirical knowledge prevails to-day that did a century ago. The difference is one of degree rather than kind. While a wrong deduction at the present day would not become as fixed and deep-seated as formerly before the error would be detected, our agriculture is on so much more intensive and extensive scale that in the meantime more harm would have been done. The reason for investigation which will go beyond the economic result and extend our definite knowledge into many new lines which are now obscure was never more evident than at the present time. The need for it arises not only out of the necessities of the stations themselves in giving reliable and intelligent advice to the farmer, but from its importance to all agricultural teaching.

Agricultural instruction rests in a very large degree upon the facts which have been worked out by the experiment stations and similar agencies for investigation. Previous to their establishment the amount of material suited to agricultural instruction was small and was made up largely of empirical knowledge coupled with the experience of good farming. The work of the experiment stations has immensely broadened the fund of known facts and has laid a broad foundation for a science of agriculture. It has thus opened the way for placing agricultural teaching upon a better pedagogic basis.

This is the most important permanent result of our station work. Its broad influence and permanent value far outweigh the results which stop with the immediate answer to a practical question. As the progress of agricutural education in the past has been linked with agricultural investigation, so its higher development in the future will depend upon the development of agricultural science and the arrangement of the material in pedagogic form. In promoting this the experiment stations are keeping entirely within their legitimate province. They owe a duty to agricultural education which no other agency can discharge. In the highest sense they are institutions for education—education in the science as well as in the art.

In their annual reports for the past year President Hadley, of Yale, and President Jordan, of Leland Stanford, both have some interesting things to say upon the relations of instruction and investigation. Both emphasize the importance of research to the teacher and urge it as a logical and important phase of university work.

Doctor Jordan says: "To the university teacher individual research is the breath of life, and it is the duty of the institution in every reasonable way to foster its development. . . . No one can be a great teacher without the spirit of research; without this he lags behind the progress of knowledge, and his mental equipment becomes second hand." While in the case of most university men the practical purpose of research is that of making them better teachers, it

is held that a reasonable following of students is usually an aid to research and not a hindrance. Both presidents agree that the investigator and the results of his work are more fully realized when he couples with his investigation in a restricted way the work of the teacher.

President Hadley cautions against the danger of creating a separate or privileged class of research professors. "In some universities," he says, "there is a tendency to set some men apart for discovering new truth, while employing other men to teach old truth. This is a mistaken policy. We are not dealing with an ordinary case of division of labor. The chief argument for division of labor is that it makes each man more expert and more efficient in his own field of work. In university work, however, the man who tries to investigation distributed as widely as possible throughout the teach-who attempts to teach without investigating becomes a worse teacher instead of a better one. We want the opportunities for research and investigation distributed as widely as possible throughout the teaching force and the student body. We want to impress upon every man that teaching and discovery are both done at their best when done in combination."

But in making this statement President Hadley evidently refers to teaching in a broad sense, for he explains that "not every man should be compelled to lecture to classes, whether he is able to do so or not." There is a great deal of valuable teaching which is not done in the class room, or even in the laboratory. There are some men who teach best by their writings, their conversations, their intelligent suggestions for the work of others; but they should understand that they are part of the teaching force, and are simply doing their teaching in a different way from other men. Instead of setting such a man apart as a research professor, we should let him understand that withdrawal from the lecture room and relief from the duties of supervising elementary students carry with them a larger obligation to publish as fully as possible the results of all discoveries; to organize departments intelligently; to train up young men who can teach; and to make liberal room for such men, instead of trying to get in their way when their work becomes popular.

In this sense all our experiment station workers are teachers, and it is one of their most important functions. The Hatch Act itself requires it, and their teaching has not stopped with the bulletins and reports prepared in the line of regular duty.

A recent somewhat incomplete summary of their writings in permanent book form shows nearly 400 treatises, by 200 authors connected with the colleges and stations. These books cover practically the whole realm of agricultural science and practice, and draw largely upon the work of the stations. They indicate in a striking manner

the rapid progress which is being made in this country in building up a substantial body of agricultural literature, based upon the more definite and reliable information furnished by investigation.

The retirement of Director R. J. Redding, of the Georgia Station, will be learned with regret by his many friends and colleagues in experiment station work.

Director Redding is one of our oldest station officers in point of service, having come into the work when the station was moved from Athens to Griffin in 1890. The laying out of the fields and grounds at that place and the planning of its work devolved upon him; and the systematic conduct and careful attention to details which have characterized the work under him, as indeed all of the business of the station, reflect much credit upon his administration.

His career in the service of agriculture has been a long and honorable one, crowned with much practical usefulness, and he will lay down his work with the respect and esteem of all who have known him. The resolutions passed by the board of directors of the station in accepting his resignation evidence the appreciation of his services and the warm regard in which he is held.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

The detection of natural phosphates in phosphatic slags, L. LEDOUX (*Bul. Soc. Chim. Belg., 19 (1905), No. 8–9, pp. 265, 266*).—The author proposes the following method, based upon the complete solubility of the phosphoric acid of pure slags in citric acid: Digest 3 gm. of the fine-ground material in 50 cc. of 40 per cent citric acid for one-half hour, shaking every 2 minutes; filter and treat the residue with 25 cc. of 40 per cent citric acid for one-half hour; filter and wash with hot water; dissolve the residue from the second treatment in nitric acid and test for phosphoric acid with ammonium nitro-molybdate. If the slag has not been adulterated with natural phosphate no reaction for phosphoric acid will be obtained.

The determination of the actual agricultural value of phosphatic slags, A. GRÉGOIRE (*Bul. Soc. Chim. Belg., 19 (1905), No. 8–9, p. 268*).—Analyses of 25 samples of crude slag obtained directly from the works showed 4 to 12 per cent of phosphoric acid, 43 to 55 per cent of total lime, and 0.7 to 7.5 per cent of free lime. The silicic acid content was inversely proportional to that of lime. The solubility of the phosphoric acid in 2 per cent citric acid was 76 to 100 per cent. There was apparently no relation between free lime and the citric acid solubility of the phosphoric acid. The solubility of the phosphoric acid in ammonium citrate containing fluorids was 47 to 86 per cent.

A study of methods of determining phosphoric acid in phosphatic slag and natural phosphates, E. RUWET (*Bul. Agr. [Brussels], 22 (1906), No. 2, pp. 206–212; abs. in Bul. Soc. Chim. Belg., 20 (1906), No. 7, pp. 244*).—Comparative studies are reported from which the author concludes that the precipitates obtained in the Sonnenschein molybdic method contain $Mg_3\ (PO_4)_2$, as well as $MgNH_4PO_4$, making the factor 0.8102 inapplicable, but that the precipitate obtained in the citro-mechanical method presents no such difficulties.

On methods of determination of phosphoric acid in artificial fertilizers, P. CHRISTENSEN (*Om Metoder til Bestemmelse of Fosforsyre i Kunstig Gödning. Copenhagen, 1905, pp. 105*).—A monograph on this subject which was awarded a prize offered by the Royal Danish Academy of Sciences.

A new modification of the method of determining phosphoric acid as magnesium-ammonium phosphate with especial reference to fertilizers, G. JÖRGENSEN (*Ztschr. Analyt. Chem., 45 (1906), No. 5–6, pp. 273–315; abs. in Chem. Centbl., 1906, II, No. 4, pp. 359, 360*).—The essential feature of the modification of his former method (E. S. R., 10, p. 934) which the author proposes consists of the precipitation of the ammonium-magnesium phosphate in a boiling solution.

Indirect determination of small amounts of magnesia by weighing the phosphoric acid of ammonium-magnesium-phosphate as phosphomolybdic anhydrid, G. BERJU (*Chem. Ztg., 30 (1906), No. 68, pp. 823–825*).—Tests of the precautions which must be observed in order to obtain a phosphomolybdic pre-

cipitate of constant composition and to thus insure the accuracy of the determination are reported.

Investigations of the solubility of the phosphoric acid in some typical Swedish soils, G. NANNES (*K. Landtbr. Akad. Handl. och Tidskr., 44 (1905), No. 6, pp. 387–402*).—Analyses of a number of Skaraborg County soils on which field trials were conducted showed that no sharp line can be drawn between available and nonavailable phosphoric acid by means of the solubility in 2 per cent acetic, citric, or hydrochloric acid, while the water-soluble phosphoric acid appeared to give valuable hints in this direction. This corroborates the results of T. Schloesing, jr. (E. S. R., 14, p. 233), on this point.

The Dyer method for determining the available phosphoric acid by means of a citric-acid solution in the author's trials gave results corresponding with those of the field trials in the case of clay soils only, while for other types of soils no definite agreement in results could be traced.—F. W. WOLL.

On the chemical equilibrium observed when a number of bases are simultaneously associated with phosphoric acid, M. BERTHELOT (*Ann. Chim. et Phys., 8. ser., 8 (1906), July, pp. 289, 290*).—This is a reply to a criticism in Quartaroli's article previously noted (E. S. R., 17, p. 1036).

Analysis of nitrate of soda, R. BENSEMANN (*Ztschr. Angew. Chem., 19 (1906), No. 11, pp. 471–473*).—Various modifications of the author's methods previously described (E. S. R., 17, p. 952) to make them apply with more accuracy to potassium nitrate or to sodium nitrate rich in potash are explained.

On two new color reactions for nitric acid, C. REICHARD (*Chem. Ztg., 30 (1906), No. 65, pp. 790, 791*).—The color reactions of berberin and arbutin are briefly described and their applications explained.

The investigation and valuation of fertilizers, feeding stuffs, seeds, and soils by the official methods of the Association of German Agricultural Experiment Stations, P. KRISCHE (*Die Untersuchung und Begutachtung von Düngemitteln, Futtermitteln, Saatwaren und Bodenproben nach den offiziellen Methoden des Verbandes landwirtschaftlicher Versuchsstationen im Deutschen Reiche. Berlin: Paul Parey, 1906, pp. 242, figs. 5*).—A summary of these methods.

Methods of determining carbon dioxid, W. HOLTSCHMIDT (*Chem. Ztg., 30 (1906), No. 50, pp. 621–625, figs. 3*).—The author explains various ways in which the use and application of a modification of the method of Stutzer and Hartleb (E. S. R., 11, p. 110), in which acid potassium tartrate is substituted for ammonium chlorid for expelling carbon dioxid, may be extended, and describes different forms of distilling apparatus suited to the methods described.

On the determination of carbon dioxid in waters, G. BRUHNS (*Ztschr. Analyt. Chem., 45 (1906), No. 8, pp. 473–488; abs. in Chem. Centbl., 1906, II, No. 12, pp. 1019, 1020*).—A modification of the Pettenkofer lime-water method, using either lime water or baryta water, and a special form of apparatus are described.

On the reliability of the Baudouin reaction, K. RÖRDAM (*Tidsskr. Landökonom., 1906, No. 6, pp. 373–378*).—A review of recent work in regard to this question, leading to the conclusion that further investigations are required to determine the value of the method for the detection of artificial butter, especially in view of the periodicity of the sesame-oil reaction in human milk observed by Engel (E. S. R., 17, p. 1006).—F. W. WOLL.

Formaldehyde: Its composition and uses, B. H. SMITH (*U. S. Dept. Agr. Yearbook 1905, pp. 477–482*).—Notes are given on the general properties of formaldehyde and the use of this material as a disinfectant, deodorant, fungicide, and preservative. Analyses of 29 commercial samples collected from dif-

ferent parts of the United States showed an average formaldehyde content of approximately 37 per cent.

Paints and their composition, E. F. Ladd and C. D. Holley (*North Dakota Sta. Bul. 70, pp. 51–136*).—In compliance with the State law the station is undertaking the examination, so far as possible, of all the brands of paint offered for sale in the State. One bulletin on this subject has already been published (E. S. R., 17, p. 636). The present bulletin contains analyses of a large number of paints, with information concerning frauds practiced, such as short weight, the cost of paints, trade and chemical names of the principal paint pigments, etc.

Report of the chemical laboratory of the Swedish Moor Culture Society, 1905, H. von Feilitzen (*Svenska Mosskulturför. Tidskr., 20 (1906), No. 3, pp. 163–188*).—The results of analyses of 1,024 sámples of moor soils, peat fuel, peat litter, lake mud, fertilizers, and miscellaneous agricultural products are given in the report.—F. W. WOLL.

Report of the chemist: Division of foods and feeding, J. B. Lindsey (*Massachusetts Sta. Rpt. 1905, pp. 65–78*).—Statements are made concerning the extent and character of the work of this division during the year. Of the 1,665 pieces of dairy glassware examined 197 were condemned on account of inaccurate graduation.

METEOROLOGY—WATER.

Meteorological reports, C. C. Georgeson (*U. S. Dept. Agr., Office Expt. Stas. Bul. 169, pp. 7, 40, 55, 60, 94–100*).—Tabular summaries are given of the reports of the volunteer weather observers of the Weather Bureau of Alaska on temperature, precipitation, and general weather conditions during the year ended September 30, 1905, and the general weather conditions at the experiment stations at Sitka, Copper Center, Rampart, and Kenai are briefly discussed.

Meteorological statistics for 1905, F. H. Loud (*Colo. Col. Pub., 12 (1906), Sci. Ser., Nos. 47–49, pp. 275–305*).—The instrumental equipment and methods of making observations at the observatory of Colorado College are briefly described and a detailed daily, monthly, and annual summary of observations on temperature, atmospheric pressure, precipitation, humidity, winds, and sunshine is given.

Colorado Springs weather records between 1872 and 1903, C. M. Angell (*Colo. Col. Pub., 12 (1906), Sci. Ser., Nos. 47–49, pp. 306–318*).—Tables give mean monthly temperature, maximum and minimum daily temperature, mean of maximum and minimum daily temperatures, maximum daily range of temperature, total monthly wind movement, maximum wind velocity, prevailing monthly wind direction, mean monthly relative humidity, total monthly precipitation, maximum daily precipitation, and number of clear, partly cloudy, and cloudy days compiled from records of the observatory of Colorado College and of the Denver office of the U. S. Weather Bureau.

Meteorological observations, J. E. Ostrander and T. A. Barry (*Massachusetts Sta. Met. Buls. 211, 212, pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during July and August, 1906. The data are briefly discussed in a general note on the weather of each month.

The weather for 1905, S. B. Doten (*Nevada Sta. Bul. 60, pp. 19, chart 1*).—An account is given by months of the weather conditions during the year 1905, with an annual summary in which the records for 1905 are compared with those for the preceding 17 years.

The data reported include observations on temperature, precipitation, cloudi-

ness, and direction of the wind. The average temperature for the year was 49.5° F., the highest temperature 98°, July 9, the lowest 7°, December 24. The total precipitation was 5.69 in., being 2.51 in. less than the normal for 17 years. There were 222 clear days during the year. There was an average daily range in temperature of 29°, the greatest variation being during the cloudless months of July and August, when the daily range was 36°, and least in January and February, when the average daily variation was 23°.

This great daily range of temperature is an important and characteristic feature of the climate of this region. "In the spring it endangers the fruit crop, for warm, sunny days are followed by nights cloudless and cold, when the frost plays havoc with bud and blossom. . . . [It] certainly has its bad influences on agriculture in this vicinity, but it is equally certain that it forms in other ways one of the most pleasant and beneficial features of our climate."

Annual precipitation in Oklahoma and Indian Territory, J. P. SLAUGHTER (*Oklahoma Sta. Rpt. 1906, pp. 57, 58*).—Tabular summaries are given of annual precipitation at various places in Oklahoma and Indian Territory during the period 1889 to 1905.

Meteorology, T. M. CARPENTER and N. C. HAMNER (*Pennsylvania Sta. Rpt. 1905, pp. 60–70, 213–234*).—The observations here recorded are of the same character as those reported in previous years (E. S. R., 17, p. 222). Monthly summaries of observations are given in the body of the report and the detailed record in an appendix. The summary for 1904 is as follows:

Summary of meteorological observations, 1904.

	1904.	Growing season (Apr.-Sept.).
Barometer (inches):		
Mean	30.086	
Highest	30.779 (Mar. 7)	
Lowest	29.305 (Mar. 8)	
Temperature (° F.):		
Mean	45.7	61.1.
Highest	89 (July 18)	89 (July 18).
Lowest	−15 (Jan. 5)	19 (Apr. 14).
Mean daily range	17.5	18.8.
Greatest daily range	43 (May 12)	43 (May 12).
Least daily range	1 (Jan. 27)	
Mean daily relative humidity (per cent)	80.8	80.3.
Rainfall (inches):		
Total	36.03	21.61.
Greatest monthly	6.30 (July)	
Greatest daily	1.79 (July 10)	1.79 (July 10).
Number of days on which 0.01 in. or more of rain fell	150	81.
Mean percentage of cloudiness	51.3	48.3.
Number of days on which cloudiness averaged 80 per cent or more.	122	51.
Average hours of sunshine per day		5 h. 50 min.
Last frost in spring		May 12.
First frost in fall		Sept. 16.

Meteorological conditions in Denmark, 1904–5, V. WILLAUME-JANTZEN (*Tidsskr. Landökonom., 1905, No. 10, pp. 517–532*).

Extension of the river and flood service of the Weather Bureau, H. C. FRANKENFIELD (*U. S. Dept. Agr. Yearbook 1905, pp. 231–240, pl. 1*).—The early history, recent extension, and present status of this service is fully explained. Beginning with the year 1904 there has been rapid extension of the service, so that at the end of 1905 there were 426 river stations and 120 rainfall stations, covering all of the principal watersheds of the United States and making adequate provision for the present needs of the service.

The following lines along which further improvement and extension may be made are discussed in detail: "(1) Geology and topography of the water-

sheds; (2) snowfall, its distribution, character, and water equivalent, the last being of essential importance; (3) forest influences, their character and extent; (4) underflow or ground water, its character and extent; (5) evaporation, its amount, seasonal distribution, and modification by winds, weather, and temperature; (6) discharge volumes as affected by all the above conditions; (7) distribution of river forecasts and information."

Some notes upon the influence of the shelter tent upon temperature and moisture, W. FREAR (*Pennsylvania Sta. Rpt. 1905, pp. 34–38, dgms. 3*).—Data are recorded for observations on temperature inside and outside of a shelter tent used for the growing of Sumatra tobacco during the week beginning August 31, 1902, and on soil moisture inside and outside of the tent during the period from July 21 to September 11.

The temperature observations show that during the night the temperature inside and outside of the tent was very nearly the same. At midday, however, the temperature inside the tent was considerably higher than outside on days of bright sunshine, a difference of 18° being observed at 3 p. m. of September 5. The soil moisture determinations showed in general that the soil under the shelter was always more moist than that in the open air except some time after heavy rains, the difference amounting on the average to 1.6 per cent, "corresponding to one-eighth of the entire average amount in the unsheltered soil, a difference sufficient to influence plant growth very materially."

Certain relations of rainfall and temperature to tree growth, H. GANNETT (*Bul. Amer. Geogr. Soc., 38 (1906), No. 7, pp. 424–434; abs. in Science, n. ser., 24 (1906), No. 611, p. 345*).—The author "finds that the timber line has a mean annual temperature of approximately 30°, but the data relating to rainfall are more definite and more significant than those of temperature. It appears that the lower limit of the yellow pine is at or just below 20 in. of rainfall. The lower limit of the red fir is at or about 30 in., and there is apparently no upper limit, the fir being abundant where the rainfall exceeds 100 in. a year. The redwood belt in California includes only one station with a rainfall less than 30 in. This seems to show that the isohyetal line of 30 in. is the lower limit of this species."

Cyclonic storms and Rochester weather, H. L. FAIRCHILD (*Proc. Rochester Acad. Sci., 3 (1906), No. 3, pp. 301–316, figs. 2*).—This article contains a general discussion of meteorological elements which go to make climate and of the two main types of climate, continental and oceanic, and summarizes observations at Rochester during the last 25 to 30 years on temperature, precipitation, cloudiness, winds, etc. The nature and movement of cyclones with special reference to Rochester conditions are also explained.

Tar smudge, A. M. THACKARA (*Mo. Consular and Trade Rpts. [U. S.], 1906, No. 309, pp. 83, 84*).—Trials of a patented tar smudge for protection of fruit against frost are briefly reported.

Guide to the weather, R. BÖRNSTEIN (*Leitfaden der Wetterkunde. Brunswick: Friedrich Vieweg and Son, 1906, 2. ed., rev. and enl., pp. 230; rev. in Amer. Jour. Sci., 4. ser., 22 (1906), No. 127, pp. 81, 82*).

Amount of chlorin in rain water, W. P. JORISSEN (*Chem. Weekbl., 3 (1906), pp. 42, 43; abs. in Chem. Centbl., 1906, I, p. 698; Jour. Chem. Soc. [London], 90 (1906), No. 525, II, p. 486*).—"As a result of 92 experiments the author has found that, in certain districts near the North Sea, the mean proportion of chlorin in rain water is about 29.6 mg. of chlorin per liter."

Chlorin in rain water (*Agr. Students' Gaz., n. ser., 13 (1906), No. 1, p. 26*).—The rainfall at the agricultural college, Cirencester, for the 6 months ended March 31, 1906, was 13.33 in., falling on 99 days, and contained chlorids equivalent to 14.26 lbs. of common salt per acre; for the 12 months ending on the same

date the rainfall was 26.77 in., falling on 182 days, and containing the equivalent of 26.22 lbs. of common salt per acre.

Composition of Indian rain and dew, J. W. LEATHER (*Mem. Dept. Agr. India. Chem. Ser., 1 (1906), No. 1, pp. 11; abs. in Jour. Chem. Soc.* [*London*], *90* (*1906*), *No. 525, II, p. 487*).—"Determinations of nitrogen as ammonia and as nitrates and nitrites in samples of rain water (generally two per month) collected at Dehra Dun from January to December, 1904, and at Cawnpore from May 1, 1904, to April 30, 1905.

"The dew collected in a large gage ($\frac{1}{1000}$ acre) at Cawnpore from September 16, 1904, to March 15, 1905, amounted to 0.170 in. and contained nitrogen ammonia=0.055 and nitric nitrogen=0.056 lb. per acre, the amounts per million varying from 0.85 to 2.65 and 0.51 to 4.12, respectively."

The prevention of the growth of algæ in water supplies (*Engin. Rec., 54* (*1906*), *No. 10, pp. 263, 264*).—An abstract is given of a paper presented at the last annual meeting of the Royal Sanitary Institute by S. Rideal and R. Orchard, reporting results of comparative tests of Moore's copper sulphate method and treatment with electrolytic chlorin. The use of 1.2 parts of the latter per million parts of water was more effective than 1 part of copper sulphate per million. The chlorin treatment is considered an effective means of preventing green growths in water and of destroying a large proportion of microscopic plants which are found in water.

A study of the numbers of bacteria developing at different temperatures and of the ratios between such numbers with reference to their significance in the interpretation of water analysis, S. DE M. GAGE (*Boston, 1906, pp. 223–257*).—This is a reprint from Biological Studies by the Pupils of William Thompson Sedgwick.

In the investigations reported in this paper 17 different classes of samples of water were examined. These classes and the methods used in their investigation are described.

The results obtained lead to the conclusion that "nearly all of the information desired concerning the bacterial content of water may be obtained by the use of selective media, by the use of selective temperatures, or by a proper combination of the two. In the present investigation the selective action of four different temperatures, 20°, 30°, 40°, and 50° C., and two different media, regular agar, and litmus-lactose agar, in determining the bacteriological contents of a number of different kinds of water, have been studied; and while the results obtained have been in many cases inconclusive, and in other cases too few in number to warrant the drawing of any far-reaching conclusions, they indicate in a measure the procedures which must be followed in order to place the bacteriological analysis of water on the same plane as the chemical analysis."

The substitution of litmus-lactose agar for agar or gelatin as culture medium is recommended on the ground that the former permits the simultaneous determination of the total bacteria and of the acid-producing organisms without appreciably increasing the labor involved. "The numbers of the two classes of bacteria so determined indicate more completely the character of the water than would the numbers of either class determined alone."

The total number of bacteria determined at 20° C. is not of special significance, but the number of acid-producing organisms at this temperature is an important check upon the total numbers. The number of bacteria and of acid-producing organisms determined at 30° C. after 24 hours' incubation affords a means of more sharply distinguishing between polluted and pure waters than the numbers determined at lower temperatures. "The numbers of bacteria determined at 40° C. are of great interest, since in this class of bacteria must be included the disease-producing organisms. The distinction between waters of different

kinds and between waters of the same kind representing different degrees of pollution is well marked by counts at this temperature.

On the progress of self-purification in water, HOFER (*München. Med. Wchnschr., 52 (1905), pp. 2266–2269; abs. in Chem. Centbl., 1906, II, No. 7, p. 637*).—A discussion of chemical and biological processes with special reference to the Isar.

SOILS—FERTILIZERS.

Studies of Wisconsin soils, A. R. WHITSON and C. W. STODDART (*Wisconsin Sta. Rpt. 1905, pp. 262–281, figs. 9, map 1*).—The soils of the State are classified, chiefly according to origin, and the different classes are described and mapped as follows: (1) Red clay, chiefly of lacustrine origin, (2) last glacial clay on crystalline rock, (3) old glacial clay on crystalline rock, (4) last glacial clay on limestone and sandstone, (5) old glacial clay on limestone and sandstone, (6) residual clay on limestone, (7) sandy soils of last glacial period, (8) residual sandy loam soils of Potsdam sandstone, (9) residual sandy soils of Potsdam sandstone, (10) loess or soils chiefly of wind origin, and (11) muck and peat soils.

The methods of chemical analysis used are described and the results of analysis of the different type soils are briefly reported, and an experiment begun by F. H. King, in which a study has been made of the changes which take place during the exhaustion of soil fertility by continuous cropping, is reported. In these experiments a virgin soil has been cropped practically continuously for 8 years in cylinders 18 in. in diameter and 42 in. in depth, 20 of the cylinders being cropped with corn, 8 with oats, 6 with potatoes, and 14 with common red clover.

To determine the fertilizing constituents in which the soil was deficient various kinds and combinations of fertilizing materials were applied to the soil, and chemical analyses were made of the soil at the beginning and end of the series of experiments. The results show that the supply of available potash was more completely exhausted than that of any other element, although in the case of oats the available nitrogen and phosphoric acid were also insufficient. Chemical analysis showed that the most noticeable change which had taken place in the soil was the reduction of the organic matter from 3.24 per cent to 2.22 per cent "and suggests that the potassium which has been used by the plants grown on this soil has come chiefly from the organic matter which has been decomposed."

Experiments with peat soils which were begun in 1904 (E. S. R., 16, p. 755) were continued during 1905 on a farm at Marinette, Wis., the object of the experiments during this year being "first, to determine the fertilizer requirements of the soil in its virgin condition; second, the availability of untreated rock phosphate; third, the relative adaptability of different grasses for hay; and, fourth, the effect of ground limestone used to neutralize the acidity of this soil."

Experiments with grasses, barley, and oats are briefly reported. The season was unfavorable and the results are considered inconclusive.

[Acidity and nitrogen in Hawaiian soils], E. C. SHOREY (*U. S. Dept. Agr., Office Expt. Stas. Bul. 170, pp. 28–37*).—A brief preliminary report is given on acidity determinations in 25 samples of soils by the method of Hopkins, Knox, and Pettit. Only 2 samples were acid to litmus paper, but all gave acid solutions when extracted with 5 per cent salt solution. The acidity apparently did not interfere to any great extent with nitrification, since the soils examined contained from 15 to 55 parts per million of nitrates. It was observed that

there was a large decrease in nitrates when a soil was allowed to stand for some time in contact with water. The greatest amount of nitrates at the end of 24 hours was found in soil to which about two-thirds of the water required for saturation had been added and declined as saturation was approached. The addition of a small amount of chloroform or heating of the soil after saturation with water to 125° C. for 5 minutes prevented this change of nitrates in case of all the soils examined.

Investigations are reported which indicate that excessive rains do not wash the nitrates from the soil as rapidly as has been supposed. "While the samples of soil examined in this work have not been numerous, extreme types have been included from different islands, and the data obtained are sufficient to warrant the assertion that a widespread characteristic of Hawaiian soils is that when they are at or near the saturation point with respect to water there is a change of nitrates and an apparent fixation of a portion of the nitric nitrogen in a form not easily soluble."

Previous investigations on the constitution of the nitrogenous compounds in Hawaiian soils were continued. It was found that while the percentage of nitrogen compounds in the soils is large, their solubility in water is low although more readily soluble in hot acids and alkalis. Hot acid solutions were studied by the Osborne and Harris method. The striking point observed was the large amount of nitrogen contained in the magnesia precipitate and the conclusion was reached "that in the soil nitrogen which is soluble in boiling acids a portion, approximately 50 per cent, is in a form unlike, for the most part, the products of decomposition of protein bodies with acids."

On dry distillation the soils rich in nitrogen examined gave an alkaline distillate containing ammonia, as well as pyridin and some of its homologues not yet identified. The author believes that the pyridin exists in some form in the soil and reports some preliminary studies of oxidation of the soil by neutral and alkaline permanganate, which, however, yielded no very definite results.

The exploitation of peaty soils, F. NICOLLE (*Jour. Agr. Prat., n. ser., 11 (1906), No. 25–26, pp. 758–761*).—The methods of reclaiming and bringing under cultivation of such soils are briefly discussed, especially methods of drainage and fertilizing. Fertilizer experiments on peaty soils are cited as indicating that although potash is deficient in many cases, peaty soils are as a rule more benefited by phosphatic fertilizers, particularly phosphatic slag, than by potash fertilizers.

Shifting sands, W. S. BIRGE (*Amer. Inventor, 15 (1906), No. 9, pp. 230, 231, figs. 4*).—A brief account of the work of this Department on Cape Cod, Massachusetts, with sand-binding grasses.

Soil temperatures, C. C. GEORGESON (*U. S. Dept. Agr., Office Expt. Stas. Bul. 169, pp. 91–93*).—Readings at 7 a. m. of thermometers 6 in. above the ground and 6 and 24 in. below at the experiment stations at Sitka, Copper Center, and Kenai during the season of 1905 are reported.

Hints for agricultural associations (*Cent. Agr. Com. Madras Circ. 6, pp. 5*).—Among the more important subjects briefly discussed in this circular are reclamation of alkali land, the use of various kinds of manures, tillage, irrigation, new crops, and cultural methods. The means which it is claimed have been successfully employed in India for reclaiming alkali lands include hurdling cows on the area and thus allowing the manure to accumulate, green manuring, fencing to increase growth of natural herbage, use of crude calcium nitrate from artificial niter beds, plowing in paddy straw (on wet alkali lands), and application of gypsum. The artificial preparation of niter is explained.

The improvement of wet and alkali meadows, J. FARCY (*Jour. Agr. Prat., n. ser., 11 (1906), No. 18, pp. 565, 566*).—Methods of drainage, irrigation, and fertilizing which will correct the unsatisfactory conditions are briefly described.

Investigations on the insoluble alkali compounds existing in the humus substances of the soil and their rôle in plant physiology and agriculture, M. BERTHELOT (*Ann Chim. et. Phys., 8. ser., 8 (1906), May, pp. 5–9; abs. in Chem. Ztg., 30 (1906), No. 58, Repert. No. 22, p. 232*).—See E. S. R., 17, p. 644.

The removal of salts from soils in Egypt, R. ALADJEM (*Jour. Agr. Prat., n. ser., 12 (1906), No. 33, pp. 215, 216*).—The methods of flooding and drainage employed for this purpose are described.

A saline soil of the lower valley of the Po, V. PEGLION (*Atti R. Accad. Econ. Agr. Firenze, 5. ser., 3 (1906), No. 1, pp. 59–64*).—The proportion and the composition of the soluble salt (alkali) in the soil are reported.

On the absorption of alkaline carbonates by the mineral constituents of soils, J. DUMONT and L. MAQUENNE (*Compt. Rend. Acad. Sci. [Paris], 142 (1906), No. 6, pp. 345–347; abs. in Rev. Sci. [Paris], 5. ser., 5 (1906), No. 7, p. 210; Jour. Chem. Soc. [London], 90 (1906), No. 522, II, p. 249*).—The extent of absorption due to chemical changes was determined by measuring the amount of carbon dioxid evolved when a solution of potassium carbonate was added to moistened clay, fine sand, kaolin, silica, iron hydrate, and alumina, and allowed to stand for some time.

The results indicate that the sandy constituents of soils do not exert any decomposing action on alkaline carbonates; kaolin acts very feebly in this respect; silicic acid even when dried decomposes potassium carbonate in the cold, but to a less extent than other colloidal substances; hydrates of iron and aluminum act very energetically, and the action of alumina particularly is in all respects comparable with that of clay. It appears that the absorbent property of clay exceeds that of its constituents taken individually or collectively.

In a note on this article Maquenne maintains that the absorbent property of clay is due to and is a necessary consequence of its chemical composition. The position of the OH groups in clay is such that the latter can form with both bases and acids, compounds which are probably dissociable by water.

On the influence of bacteria on the metamorphosis of nitric acid in soils, J. STOKLASA and E. VITEK (*Ztschr. Landw. Versuchsw. Österr., 9 (1906), No. 2, pp. 49–105*).—The authors' investigations with a great variety of organisms in different media lead to the conclusion that nitrous acid is always the intermediate product in the reduction of nitrates by these organisms. It was found that carbon dioxid and hydrogen are produced from the carbohydrates or organic acids of the culture media and that the nascent hydrogen combines with the oxygen of the nitrates to form water and thus reduces the latter to nitrites. A hypothetical scheme for such breaking down of glucose with production of hydrogen is given. In the same way denitrifying organisms reduce chlorates to chlorids, arsenates to arsenites, ferricyanids to ferrocyanids.

Certain of the most widely distributed carbohydrates in soils and manures, as for example, xylose and arabinose, are not specially good nutrients for denitrification bacteria, but favor slow ammonisation of nitric and nitrous acids. It is true, however, that the typical denitrifying organism *Bacillus hartlebi* in a medium containing arabinose was able to assimilate 33.62 per cent of the nitrogen of nitrate and convert it into protein substances. The soil also frequently contains carbohydrates, such as the hexoses, and organic acids, which favor denitrification. Nevertheless, denitrification as a rule plays only a secondary rôle to nitrification and ammonisation in soils.

The authors' studies of a number of beet soils showed that the ammonisation bacteria predominated in them, *Clostridium gelatinosum* being especially prevalent, but associated with other organisms which play an important part in con-

verting nitrate nitrogen into ammonia nitrogen, viz, *Bacillus mycoides*, *B. subtilis*, *B. mesentericus*, and others.

It was found that *Clostridium gelatinosum* in an arabinose medium converted 46 per cent of nitrate nitrogen into ammonia nitrogen and utilized about 6 per cent of the nitrogen in the production of protein substances.

[Indian soils and fertilizers], J. W. LEATHER (*Ann. Rpt. Imp. Dept. Agr. [India], 1904–5, pp. 53–63, fig. 1*).—The work of the agricultural chemist to the Government of India during the year ended June 30, 1905, and during previous years is summarized, including studies of available plant food in soils, alkali, combined nitrogen in rain and dew, amount and nitrate content of drainage water, composition of well and canal waters, composition of manures, purification of sewage, composition of canal silt, and methods of artificial preparation of saltpeter.

The soil studies indicate that nitrogenous manures are generally needed by Indian soils, the sulphates vary widely and are sometimes deficient; in the usar or alkali soils the proportion of alkali in the upper 6 or 12 in. rarely exceeds 1 to 2 per cent and is commonly much less. The principal constituents of the alkali are sodium carbonate and bicarbonate, silicate, sulphate and chlorid, and magnesium sulphate and chlorid are occasionally present. The greatest injury is caused by the sodium carbonate, both by its corrosive action and by its bad effect on drainage. The most effective remedies for alkali which have been tried are good cultivation combined with heavy manuring and the application of gypsum. Drainage has not proved successful on account of the silting up of the tile. The gypsum treatment is too expensive for general use on very bad land.

The total nitrogen in the annual rainfall (87.45 in.) at Dehra Dun was 3.596 lbs. per acre and at Cawnpore (49.36 in.), 3.25 lbs. Dew was much richer in nitrogenous compounds than rain water (2 to 4 parts per million). The proportion of nitric nitrogen was relatively larger in dew than in rain. It usually equaled and sometimes exceeded the ammonia, the reverse of what would be expected. Percolation at Cawnpore was the same from a 3-ft. drain gage as from a 6-ft. gage.

The amount of nitric nitrogen removed per year in drainage water from bare soil was about 74 lbs. per acre for the 3-ft. gage and 123 lbs. for the 6-ft. gage.

It is reported that examination of certain well waters from Gujarat, which had been found to have a particularly beneficial effect on tobacco, showed the presence of large amounts of potassium, sodium, and calcium nitrates. The proportion of nitrates was so large that the waters could not be used without previous dilution.

The investigations on sewage reviewed in this article have already been referred to in the Record (E. S. R., 15, p. 762). One of the principal objects of these investigations was to ascertain the rate of hydrolization of organic nitrogen in septic tanks and of purification in contact beds. It was found "that the rate of change was considerably greater when the concentration of this organic nitrogen was high than when it was low, and that for a strong sewage a relatively smaller tank would be required than for a weak sewage. Secondly, there seemed to be a limit to the destruction of this organic matter. . . . After the amount of this nitrogen had fallen to about 1 part per 100,000 (hundred thousand), no further diminution occurred. . . . Out of every 100 parts of nitrogen in the fresh sewage, from 10 to 20 were lost in the septic tank, and a further 10 to 20 were lost in the bacteria bed treatment. The total loss experienced varied from 30 to 40 parts. The magnitude of this loss has not apparently any relation to the strength of the sewage, for it was nearly as great when the weak as when the strong sewage was being treated."

Examinations of canal water used for irrigation of wheat, rice, and sugar cane showed that during the flood season the silt in the amount of water used on rice would carry as high as 32 lbs. of nitrogen and 42 lbs. of phosphoric acid. The amount used on the wheat crop, however, would probably furnish not more than 5 lbs. each of nitrogen and phosphoric acid.

The process of percolation employed in Indian saltpeter works to obtain a strong, almost saturated, solution of salts is briefly described, and a study of the composition of "sitta," a product obtained in the process of refining the saltpeter, is reported. The product is mainly sodium chlorid, but often contains admixtures of from 2 to 14 per cent of saltpeter, which mainly determines its agricultural value.

Plan for a soil test with fertilizers, W. Frear (*Pennsylvania Sta. Rpt. 1905, pp. 22–25, pl. 1*).—A plan of an experiment to determine the most profitable kinds of fertilizing materials to apply to corn or wheat is described.

Cooperative fertilizer trials in Sweden, 1905, P. Bolin (*K. Landtbr. Akad. Handl. och Tidskr., 1906, Bihang, pp. 121*).—The fertilizer trials discussed in this report were conducted in 14 different counties by county agricultural societies in cooperation with the Royal Agricultural Academy. Two hundred and fifty-four different trials, including about 7,000 plats in the aggregate, were conducted, viz, 130 trials with spring grains, 88 with root crops, 35 with pastures or meadows, and 1 with winter grains. The general plan of the trials was similar to that of earlier years (see E. S. R., 15, p. 569; 17, p. 654). The report contains complete details as to the conditions under which the individual trials were conducted, the system of fertilization adopted, and the results obtained, with general discussions of the latter.

Among special trials conducted during the year the following may be noted:

Comparative trials with ammonium sulphate and nitrate of soda.—These trials were conducted with potatoes (9 trials), mangels (5 trials), fodder beets (3 trials), and oats (8 trials). The fertilizers were applied at the rate of either 35 or 25 lbs. of nitrogen per acre for the crops mentioned, except for oats, which received nitrogen at the rates of 25 and 12.5 lbs. per acre. In the case of the former crops, 356 lbs. of superphosphate and 178 lbs. of potash salt per acre were applied, in addition to the nitrogen fertilizer, and for oats, 267 lbs. of superphosphate and 89 lbs. of potash salt. If the increase in yields produced by the nitrate of soda over that on the control plats be taken as 100, the effect of the ammonium sulphate was, on the average, as follows for the various crops: Heavy nitrogenous fertilization—potatoes 63, mangels 78, fodder beets 71, and oats, grain 97, straw, 78; light nitrogenous fertilization—potatoes 54, mangels 60, fodder beets 77, and oats, grain 78, straw 63. The effect of the ammonium sulphate in this year's trials, on the average for all trials and all crops, was equal to 72 per cent of that of a corresponding amount of nitrate of soda.

Comparative trials with cyanamid, lime niter, ammonium sulphate, and nitrate of soda.—The first fertilizer contained about 20 per cent of nitrogen, and the second one (Birkeland and Eyde process) about 11 per cent. Only one of the series of trials planned was carried through successfully, viz, with oats on clay soil. The results obtained showed that for this crop and soil the fertilizer value of the lime niter was fully equal to that of the nitrate of soda, calculated on the same quantities of nitrogen, and that the action of the cyanamid is quite similar to that of ammonium sulphate.

On the best time of liming fallow ground.—A field of clay soil seeded to rye on August 16, 1904, was divided into plats, some of which were manured and limed, while others were either manured or limed only. The manure was applied June 14, and the slaked lime (3,000 kg. per hectare) either on the same

date or August 16. The best results both as regards grain and straw were obtained on the manured and limed plats where the lime was applied on the latter date. The lime applied at the time of manuring did not produce as good results as manure alone, there being an average increase in grain over the yield on the plats neither manured nor limed amounting to 270 kg. per hectare in the latter case against 170 kg. in the former and 470 kg. in the case of the manured plats that were limed August 16. The lime alone (applied August 16) did not produce any beneficial effect, the yield obtained being even somewhat lower than that of the control plats which were neither manured nor limed. The results show plainly that lime will give best results on fallow ground when applied late in the fall.—F. W. WOLL.

The assimilation of mineral matter by different crops in vegetation experiments with calcareous manures carried on from 1896 to 1903, R. ULBRICHT (*Landw. Vers. Stat., 63 (1906), No. 5–6, pp. 321–374; abs. in Jour. Chem. Soc.* [*London*], *90 (1906), No. 523, II, p. 304*).—This article reports plat and pot experiments with lime, marl, and limestone on potatoes, oats, corn, rye, barley, rape, yellow lupine, vetch, red clover, and serradella in continuation of those of previous years (E. S. R., 15, p. 860; 16, p. 32). The influence of the different calcareous manures on the growth and plant food assimilation of the crops is discussed in detail, especially in case of the leguminous crops.

"Application of lime resulted in a slightly diminished assimilation of nitrogen and phosphoric acid in the case of lupines, vetches, and serradella, whilst the potassium was increased in lupines and serradella, but not in vetches. The magnesia in all three plants was considerably increased by manuring with calcium and magnesium carbonates and was distinctly increased even by burnt Carrara marble, which contains only small amounts of magnesium."

Agricultural value of poultry manure, H. V. HAWKINS (*Year Book Agr. Victoria, 1905, pp. 427, 428*).—Observations with Dorkings, averaging 8 lbs. each, showed that the manure produced during the daytime amounted to $1\frac{1}{2}$ oz. per bird, and during the nighttime 2 oz., or 46 lbs. per annum. The fertilizing value of well-cared-for manure is discussed and the best means of preserving the manure are explained.

Artificial fertilizers, F. E. LEE (*Year Book Agr. Victoria, 1905, pp. 115–137, figs. 12*).—This is a general discussion of the subject, including explanations regarding the need of fertilizers, the valuable constituents of fertilizers, the fertilizers on the Victorian market during 1905, hints on mixing artificial fertilizers, comparison of fertilizers with farmyard manure, the valuation of fertilizers, and a summary of the fertilizer law of Victoria.

Nitrogen from the air (*Mark Lane Express, 94 (1906), No. 3897, p. 613*).—This is a brief note on an address by P. A. Guye before the Society of Chemical Industry on the problem of the electro-chemical fixation of nitrogen. Attention is here called especially to the relative cost of nitrogen fixation by the calcium cyanamid and the electro-chemical methods. It was estimated that the cost of nitrogen fixed as calcium cyanamid will be about the same as that in the ammoniacal salts and the nitrates of Chile. Under present conditions the electro-chemical method is believed to be somewhat cheaper.

On the spontaneous formation of dicyandiamid in fertilizers containing calcium cyanamid, R. PEROTTI (*Atti R. Acad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 15 (1906), I, No. 1, pp. 48–53; abs. in Chem. Centbl., 1906, I, No. 17, p. 1467; Jour. Chem. Soc.* [*London*], *90 (1906), No. 523, II, p. 304*).—The author shows that when calcium cyanamid is exposed to moist air a portion of the nitrogen escapes as ammonia and a part is transformed into dicyandiamid. These changes are important because of the loss of nitrogen and also because the fertilizing value of the dicyandiamid has not been definitely determined.

Nitrate of soda as compared with a mixture of nitrate of soda and sulphate of ammonia, D. FERUGLIO (*Ann. R. Staz. Sper. Agr. Udine, 8 (1906), pp. 72–76*).—The results of plat experiments with wheat here reported indicate that the nitrate alone in 2 applications was more effective than a mixture of nitrate of soda and sulphate of ammonia.

The influence of soil bacteria on the solubility of the phosphoric acid of different phosphates. A. KOCH and E. KRÖBER (*Fühling's Landw. Ztg., 55 (1906), No. 7, pp. 225–235; abs. in Chem. Ztg., 30 (1906), No. 34, Repert. No. 12, p. 144*).—Bacteriological and chemical studies with a large number of insoluble phosphates showed that bacteria produce acids which render such phosphates soluble. These acids must, however, first neutralize ammonia, lime, or calcium and magnesium carbonate, and similar substances which may be present. The bacteria work on all phosphates, but at varying rates, depending upon the composition. They work with particular rapidity on Thomas slag once the basic constituents are neutralized. A larger amount of acid is required, as a rule, than the chemical reaction would indicate. The better action of bone meal on humus soils is due not only to the solvent action of the humus and carbon dioxid but also to the greater activity of acid-forming bacteria in such soils. The application of lime neutralizes these acids and thus interferes with their solvent action on the phosphates.

Aluminum phosphate as compared with mineral superphosphate and Thomas slag, Z. BONOMI (*Ann. R. Staz. Sper. Agr. Udine, 8 (1906), pp. 26–32*).—Pot experiments on spring wheat and clover with these phosphates combined with other fertilizing materials are reported.

The aluminum phosphate used contained 20.48 per cent of phosphoric acid soluble in neutral citrate, 14.72 per cent soluble in Wagner's solution, 42.37 per cent soluble in alkaline citrate, and 45.56 per cent total phopshoric acid. The superphosphate contained 13.25 per cent of phosphoric acid soluble in neutral citrate, the Thomas slag 10.18 per cent soluble in neutral citrate and 13.89 per cent soluble in Wagner's citric-acid solution.

The results show that the aluminum phosphate produced a substantial increase of yield in case both of clover and wheat, but was always inferior to the superphosphate. In case of spring wheat the aluminum phosphate was inferior to the Thomas slag, but superior to it in case of the clover.

Calcium superphosphate as compared with Thomas slag, Z. BONOMI (*Ann. R. Staz. Sper. Agr. Udine, 8 (1906), pp. 38–65, pl. 1*).—Comparative field tests are reported of Thomas slag containing 14.5 per cent of phosphoric acid soluble in citric acid and 10 per cent of free lime, and mineral superphosphate containing 9.38 per cent of phosphoric acid soluble in water and 13.18 per cent soluble in neutral citrate solution. The results show in general that the Thomas slag was the more economical fertilizer, but in many cases the superphosphate supplemented by applications of lime gave larger increase in yield.

The economical use of potash fertilizers, Z. BONOMI (*Ann. R. Staz. Sper. Agr. Udine, 8 (1906), pp. 77–87*).—The results of field experiments on red clover were somewhat inconclusive. Although the use of potash fertilizers in all cases increased the yield, in many cases this was not sufficient to return the cost of the fertilizer. The author therefore concludes that potash fertilizers should be used with caution.

Sulphate of potash, L. BARGERON (*Jour. Agr. Prat., n. ser., 11 (1906), No. 21–22, pp. 667, 668*).—This article discusses briefly the sources, manufacture, and consumption of this salt, as well as the relative economy of sulphate and chlorid of potash.

Salt, F. E. ENGELHARDT (*Syracuse, N. Y.: Author [1906], pp. 15*).—An account is given of the formation of salt deposits in general and of the discovery

and character of the deposits in the United States, with a more detailed account of the rise and decline of the Syracuse salt industry and the borings made to discover the source of the Onondaga brines.

Fertilization, R. J. Redding and H. N. Starnes (*Georgia Sta. Bul. 72, pp. 121–143*).—"The purpose of this little bulletin is to furnish a handy manual for the use of farmers concerning the methods of culture of the leading farm, orchard, and garden crops of the South, and the formulation of fertilizers for the same. . . . The suggestions and formulas are largely based on carefully conducted experiments in the field, orchard, and garden, some of them many times repeated, on the Georgia Experiment Station farm. They are here compiled, with amendments, from previous bulletins that have appeared from time to time during the last 15 years."

Analyses of fertilizers, C. A. Goessmann (*Massachusetts Sta. Bul. 111, pp. 28*).—This bulletin gives market values of fertilizing ingredients and reports analyses of licensed fertilizers collected in the general market and miscellaneous fertilizing materials sent to the station for examination, including wood ashes, lime ashes, prepared lime, oyster-shell lime, nitrate of soda, sulphate of ammonia, nitrate of potash, saltpeter waste, dried blood, linseed meal, cotton-seed meal, high-grade sulphate of potash, potash magnesia sulphate, carbonate of potash and magnesia, dissolved boneblack, acid phosphate, burned bone, phosphatic slag, dissolved bone, ground bone, fine-ground bone and tankage, tankage, dry ground fish, bone waste, horn waste, beef scrap, sheep manure, cotton waste, sludge from filter beds, manure and lime, leather refuse, Chincha Peruvian guano, Lobos Peruvian guano, compound fertilizers, and soils.

Compilation of analyses of agricultural chemicals, refuse salts, ashes, lime compounds, refuse substances, guanos, phosphates, and animal excrements, H. D. Haskins (*Massachusetts Sta. Rpt. 1905, pp. 155–183*).—This is a compilation of analyses made at the Massachusetts Agricultural College and Experiment Stations, 1868 to 1905, inclusive. It does not include analyses of licensed fertilizers.

Report on official inspection of commercial fertilizers and agricultural chemicals during the season of 1905, C. A. Goessmann (*Massachusetts Sta. Rpt. 1905, pp. 50–60*).—The results of examinations of 511 samples representing 313 brands are summarized. Tables show the average composition of the different classes of all fertilizer analyses, and the maximum, minimum, and average composition of special crop fertilizers. A schedule of trade values of fertilizing constituents and a list of licensed manufacturers and dealers are given.

Report on general work in the chemical laboratory, C. A. Goessmann (*Massachusetts Sta. Rpt. 1905, pp. 61–64*).—Brief notes are given on the examination of wood ashes and lime ashes.

Fertilizer analyses, fall season, 1905, to spring season, 1906, B. W. Kilgore (*Bul. N. C. Bd. Agr., 27 (1906), No. 7, pp. 83*).—The names and guaranteed composition of fertilizers registered for 1906, and analyses and valuations of 750 samples of commercial fertilizers and 76 samples of cotton-seed meal examined during the fall of 1905 and spring of 1906, with explanations regarding terms used in fertilizer analyses, freight rates, valuation, etc.

Analyses of commercial fertilizers (*South Carolina Sta. Bul. 119, pp. 37*).—This bulletin contains the analyses of 655 samples of fertilizers collected during the season of 1905–6. "These analyses were published in 20 weekly bulletins issued and distributed during the months of February, March, April, and May."

Inspection of commercial fertilizers, 1905, F. W. Woll and G. A. Olson (*Wisconsin Sta. Rpt. 1905, pp. 377, 378*).—Analyses of 15 samples of fertilizers licensed for sale in the State during the year are reported.

AGRICULTURAL BOTANY.

Report of the botanist, G. E. Stone and N. F. Monahan (*Massachusetts Sta. Rpt. 1905, pp. 115–145*).—Notes are given on a number of diseases that have been under observation. The long period of dry weather rendered many plants free from fungus diseases, but, on the other hand, the conditions were favorable for the outbreak of others. The downy mildew of the tomato, potato rot, and cucumber and melon blight are briefly noted, after which the effect of sun scald, leaf scorch of conifers and other evergreens, winterkilling, etc., are described.

An account is given of some investigations carried on to determine the relation between soil aeration and germination and growth. In these experiments air was forced through the soil, and lettuce seed, which is quite susceptible to aeration, was planted in the different boxes. From the results tabulated it is shown that a considerably larger proportion of the seed germinated in the aerated box than in the unaerated one.

A comparison of sterilized loam and sterilized subsoil was made, 8 pots being used, 4 containing loam and 4 subsoil; of these 2 each of the loam and subsoil were sterilized, and the remaining pots were left unsterilized as checks. After sterilization soy beans were planted, and in the sterilized loam there was an increase of 14 per cent in the germinations, while in the sterilized subsoil there was a loss of 57.7 per cent. No explanation of this phenomenon is offered, but it shows that extreme precautions are necessary in drawing deductions from experiments in which the soil is sterilized.

The influence of soil sterilization on the germination of old seed was tested, the object being to ascertain the degree of acceleration which would result from seed planted in sterilized soil. Seventeen lots of seed were planted in sterilized soil and an equal number in unsterilized soil. The germinations were counted, and showed a positive gain in the germination of seed sown in sterilized soil. Marked differences were obtained from different kinds of seed, tomatoes responding but little, if any, to this method of treatment. The cause of the variation in different species is unknown.

In attempting to ascertain the causes underlying the effects of sterilized soil on seed germination mentioned above, the authors carried on a series of experiments in which soil decoctions were used to water the seed. The results indicate that the acceleration and increased germinating capacity of sterilized soil may have a chemical explanation. Undoubtedly the driving out of the gases and the subsequent absorption and renewal of fresh oxygen in sterilizing practices act beneficially to the soil and induce the seed to germinate more quickly. Sterilized subsoil, or soil lacking in humus, has the same effect on germination as sterilized loam rich in organic matter, but it inhibits growth to a large extent, differing markedly in this respect. It appears from these experiments that a considerable amount of humus is necessary in soils in order that they may be materially benefited by sterilization.

The results of germination experiments to test the relative value of light and heavy seeds are given. The general conclusion is drawn that with many kinds of garden seed it is best to separate the seed and discard all but the large, well-developed, mature, and heavy seed.

The occurrence of asparagus rust during the season is discussed, this disease having been particularly troublesome in many parts of Massachusetts as the result of the extremely dry summer. Cultural methods are said to have given beneficial results in keeping this disease in check, and weekly cultivation combined with judicious fertilization has proved very satisfactory. The authors believe that the practice of burning the old asparagus brush in the fall is, by destroying a large number of teleutospores, an efficient method of control.

Spraying with Bordeaux mixture has not proved satisfactory and this method of control is no longer recommended.

An account is given of the treatment of the college pond with copper sulphate for the destruction of algæ which had become very troublesome in it. Treatment of the pond with 1 part of copper sulphate to 4,000,000 parts of water showed that after 24 hours there was a slight decrease in *Anabæna flos-aquæ*, the most common alga, and in 2 or 3 days it had practically disappeared. Spirogyra, desmids, and diatoms appeared unaffected by the treatment, and the animal life showed no ill effects, so far as the authors could observe. From examinations made of the bacterial content of the water it was found that there was a rapid decrease for the first few days after treatment, after which there was a slight increase, but that the number of bacteria per cubic centimeter of water never reached the original proportion.

A comparison of the numbers of bacteria in sterilized and unsterilized soils, A. V. OSMUN (*Massachusetts Sta. Rpt. 1905, pp. 146–148*).—A study was made of sterilized soil to determine the effects of sterilization on the bacterial flora. The stimulating effect of soil sterilization on plant growth had suggested a similar effect on the bacterial content of the soil.

To investigate this subject two boxes of equal size were filled with soil, one being treated for half an hour with steam and the other left untreated. One week after sterilization samples were taken from each box and the bacterial content determined. At the first examination a decided decrease was noted in the bacterial content of the sterilized soil as compared with the unsterilized, but after an interval of 2 weeks the number of bacteria in the sterilized soil had increased to almost double the number in the unsterilized soil and continued to be greater as long as the investigation was carried on.

From the results obtained in this experiment and from tests of other soils, both sterilized and unsterilized, the author concludes that steam treatment of soils stimulates bacterial development in them.

Notes on the formation of albuminoid substances in plants, L. MONTEMARTINI (*Atti Ist. Bot. Univ. Pavia, 2. ser., 10 (1905), p. 20; abs. in Bot. Centbl., 102 (1906), No. 28, pp. 35, 36*).—From a review of the literature it is shown that different investigators have obtained contradictory results regarding the action of light on the formation of nitrogenous material in plants.

The author carried on a series of experiments, a preliminary report of which is given. From his results it is shown that in the germination of beans and maize light exerts a very different effect, depending on the external and internal conditions under which it acts. The results of the experiments are to be given in detail at some future time.

The stimulation of the nutrition of plants, H. MICHEELS (*Rev. Hort. Belge, 32 (1906), No. 2, pp. 29–33; abs. in Bot. Centbl., 102 (1906), No. 30, pp. 90, 91*).—The author calls attention to the diverse conclusions of various investigators relative to the effects of stimulants on the nutrition of plants, some claiming that the addition of mineral fertilizers to the soil does not modify the mineral composition of the plants, but only stimulates their growth and the production of organic matter, while other investigators claim that certain mineral salts have a direct stimulating effect.

The author, in connection with a physicist, investigated the effect of various colloidal substances, and carried on experiments with barley, peas, buckwheat, and oats, which show that colloidal solutions have a direct stimulating effect and that in some cases they play the rôle of diastases. This appears to open up a new line of investigation on the nutrition of plants.

The synthesis and breaking down of organic nitrogen in plants, E. Schulze (*Landw. Jahrb., 35 (1906), No. 4, pp. 621–666*).—A critical review is given of the literature relating to the subject of nitrogenous metabolism in plants with special reference to protein, asparagin, glutamin, ricinin, lecithin, etc. The author states that no attempt is made to include all the literature, but only such as appears necessary to give an adequate knowledge of the present status of the subject.

The formation and physiological use of pentosans in plants, G. A. Calabresi (*Staz. Sper. Agr. Ital., 39 (1906), No. 1–2, pp. 69–93*).—An investigation of the occurrence of pentosans in plants was carried on, in which a considerable number of plants were studied.

The literature relating to the occurrence of pentosans in plants is reviewed, and after describing his experiments, the author summarizes his own investigations, stating that the observations of de Chalmot (E. S. R., 5, p. 1103) regarding the presence of pentosans in seeds germinated in the dark are also true for many plants in their adult stages of growth. The pentosans seem to be produced by the transformation of other substances which are formed early in the life of the plant, and with the gradual increase in the dry material of the plant they appear to diminish. The percentage of pentosans in a given plant does not depend on the external development and weight of the green plant, but under like conditions the age of the plant determines this question. The percentage of cellulose seems to have a definite relation to the amount of pentosans, but it has not yet been demonstrated that this quantitative proportion signifies any generic relationship. Among the cereals investigated, the author found that those stems which are most resistant to the effects of storms are usually richest in pentosans. In beet roots there appears to be a definite relation between the quantity of saccharine matter present and that of pentosans, the proportion of the former being less than that of the latter. In general, the greatest quantity of pentosans will be found in plants that contain the least amount of other nutritive substances.

On the relation between calcium salts and the assimilation of nitrate nitrogen, W. W. Yermakov (*Zhur. Opuitn. Agron. (Russ. Jour. Expt. Landw.), 6 (1905), p. 431; abs. in Chem. Ztg., 30 (1906), No. 22, Repert. No. 6, p. 83*).—On the basis of experiments with plants and from theoretical considerations, the author concludes that calcium is necessary to the assimilation of nitrate nitrogen in plants. The explanation of this is that the nitric acid produced in plants acts on glucose to produce ammonia, which is utilized in the formation of proteid compounds, and oxalic acid, which is precipitated by lime and thus prevented from interfering with the continuation of the process.

Tubercles on legumes with and without cultures, J. L. Sheldon (*West Virginia Sta. Bul. 105, pp. 319–334*).—The results of field, greenhouse, and laboratory tests with different forms of cultures for the inoculation of legumes are reported. These were begun in 1904 with cultures of bacteria from this Department and a commercial preparation, comparison being made with the same species of legumes grown without inoculation.

In some of the experiments the author obtained results that seemed to indicate that the germination of the seed was interfered with in some way by the treatment, and an examination of the roots of both inoculated and uninoculated plants seemed to indicate that while the use of cultures is not to be condemned they are not needed in the majority of West Virginia soils. In some cases the author attributes the failure to obtain a stand and a profitable crop of such legumes as alfalfa, clovers, and cowpeas to imperfect soil conditions and the abundance of weeds rather than a lack of bacteria. Tables are given showing the gain or loss of different crops attributed to inoculation.

FIELD CROPS.

Report on agricultural investigations in Alaska, 1905 [Field crops], C. C. Georgeson (*U. S. Dept. Agr., Office Expt. Stas. Bul. 169, pp. 39–51, 56–58, 61–63, pls. 3*).—Earlier work with field crops at the Alaska Stations has been previously reported (E. S. R., 17, p. 349). The work at the Sitka station is now devoted chiefly to horticulture.

Work at the Copper Center Station.—It has been demonstrated at this station that owing to the early frosts in August grain growing is not very successful, but that under usual conditions any amount of rough feed can be produced. It was found that new ground fertilized with guano at the rate of 500 to 600 lbs. per acre produced from 50 to 90 per cent better crops than when no fertilizer was used. Each variety of the various grains tested was grown on several tracts. On tracts A, B, and C half of each plat was fertilized at the time of seeding with guano at the rate of 500 lbs. per acre. Tracts A and C were seeded with a small hand drill. Tract B was seeded in open drills by hand and covered with the hand rake. Tract D was seeded with a horse drill. Frost on August 14 seriously injured the crops.

A crop of winter wheat sown August 3, 1904, came through the winter fairly well, and the grain was in the dough and beginning to harden when injured by the frost in August. It is believed that some of the grains will grow. Romanow spring wheat sown May 9 matured no seed. Saskatchewan fife sown May 10 was sufficiently matured for good hay by August 30, and cured very quickly when cut. Notes on a number of other varieties of wheat are given, but in every case these were injured by frost. Ladoga and Harold were the furthest advanced when the first killing frost came, and part of the grain secured was matured sufficiently to grow. These 2 varieties were followed in degree of maturity by Ebert, Plumper, Stanley, Early Riga, and Roumanian.

Silver hull buckwheat from home-grown seed from the crop of 1903 made a good growth, but was killed to the ground by frost August 14, when some of the seed was nearly matured.

Excelsior winter rye sown July 16 had the grain well filled and was in the dough on July 28. It was not matured when injured by frost, when the crop was cut for seed. True Stock spring rye on fertilized ground grew from 40 to 44 in. high, and yielded fully two-thirds more forage than oats under like conditions.

Champion barley on tract A, sown May 11, was in the hardening stage at the time of the first frost and was thrashed for seed. On tracts B and C the crop was spoiled by frost. Hanna 2-rowed barley on tract B, seeded broadcast May 23 on the ground, had matured sufficiently for good hay by August 22. Lapland was almost ripe on August 14, but the frost shriveled the grain to some extent. When the first killing frost came, August 14, Champion was the furthest advanced, being closely followed by Chevalier, Odessa, Black Hulless, Manchuria, Mansbury, Hanna No. 9133, and Primus No. 10586.

Finnish black oats on tract B, from Sitka Experiment Station seed, were little damaged by the frost, and the crop was saved for seed. On tract A, which was sown May 12, there was no visible injury from frost. Of the different varieties of oats grown Burt Extra Early ripened several days before any other variety and was thrashed before frost. Finnish, Swedish Select, Sixty-day, Improved Ligowo, and Tartar King ripened about together, and the early seedings showed no injury from the frost of August 14.

The grasses under test were in their third season of growth, but owing to a dry year poor results were secured. Red, white, and alsike clover, sown in 1903

and 1904, were winterkilled, and the plats reseeded this year made very little growth. The same was true of perennial rye grass.

Work at the Rampart Station.—The crops at this station were grown on virgin soil, without fertilizer. On the spots where stumps had been burnt a fine growth was secured, but elsewhere the stand was thin and the straw short. Mansbury barley, from Sitka-grown seed, sown May 19, was harvested September 6. This variety produced well-filled heads of good length. Rampart-grown seed gave practically the same result. The Saskatchewan fife spring wheat, from Canadian seed, did not mature, and Velvet Chaff Blue Stem only ripened partially. Spring rye, sown May 19, began to head 47 days later, but it filled so slowly that it did not fully mature. Russian buckwheat was one of the few crops killed by frost August 19. Amber, Excelsior, and Giant French winter rye, sown August 17, matured and were harvested on September 5. Kharkov winter wheat almost all winterkilled.

Work at the Kenai Station.—Oats sown May 30 and 31 stood 36 to 40 in. high on August 15, with 75 per cent of the plants headed. September 1 they were 48 to 60 in. high, but some of the grain was injured by frost. Hanna 2-rowed barley, sown May 26, was in the milk and dough stage when injured by frost, and buckwheat, sown the same day, had ripened a small percentage of its grain when killed by frost August 26. Grass seed was sown May 25, and the following heights on September 1 are recorded from different species: Tall fescue, 18 in.; timothy, 18 in.; orchard grass, 12 in.; Italian rye grass, 10 in., and a mixture of the grasses planted this season, 10 in. Seeds of wild rye, wild barley, and *Calamagrostis langsdorfii*, all native species, were much slower in germinating than the imported seed.

Report on agricultural investigations in Hawaii, 1905 [Field crops], J. G. Smith (*U. S. Dept. Agr., Office Expt. Stas. Bul. 170, pp. 13–22, 23, 24, pl. 1*).—A cooperative tobacco experiment is in progress for the purpose of demonstrating the practicability of growing the best grades of cigar tobacco in Hawaii. In connection with a brief report on the experiments some of the Hawaii tobacco soils are described, the advantages of the climate for tobacco growing pointed out, and a general outline of the cultural processes followed is given.

In 1904, at Hamakua, the following varieties were grown under cloth: Sumatra, Florida, and Long Stem; Cuban, Florida, and Vuelta Abajo; Connecticut Broad Leaf and Seed Leaf; Zimmer Spanish; Virginia Dark Leaf; White Burley, and Japanese. This year's work demonstrated that tobacco under cloth was not successful in Hawaii, at least in regions of high rainfall. Brief notes on the behavior of each variety are given. The quality of the leaf of some of the varieties was pronounced excellent by experts and manufacturers.

The results of 1905 indicated that wrapper tobacco of fine texture and body and filler leaf of mild flavor and of good burning qualities are commercial possibilities. This season the crop was grown in the open, the only protection being forest on all sides of the plat. While the quality of the tobacco produced was good, the shade was darker than the market demands. About 20 per cent of the crop of Sumatra was of excellent quality as regards texture and body, but only about 10 per cent showed desirable shades of color. This portion of the crop was valued at from \$2 to \$4.50 per pound. The yield was at the rate of about 1,000 lbs. per acre. The portion of the crop unsuited for wrappers commands a price of only about 10 cts. per pound. The leaf of the Cuban tobacco not suitable for wrappers sells at prices ranging from 15 to 40 or 50 cts. per pound. The yield of the Cuban leaf ranges from 450 to 600 pounds per acre, and fully 25 per cent of this season's crop would have been suitable for wrapper leaf if the colors had been lighter. It is estimated that if a grower

produced tobacco on his own land and with his own labor the green leaf could be produced at the cost of about 2 to 2½ cts. per pound.

General notes on the culture of cassava in Hawaii are given and its value for Hawaiian conditions is indicated.

Report on agricultural investigations in Porto Rico, 1905 [Field crops], D. W. May (*U. S. Dept. Agr., Office Expt. Stas. Bul. 171, pp. 1–17, pls. 2*).—General notes on the agricultural conditions of Porto Rico are presented and the conditions and prospects of the culture of sugar cane, tobacco, cotton, corn, rice, potatoes, and forage crops are discussed.

Experiments with cotton at the station indicate that sea-island cotton is the most profitable for Porto Rico. Egyptian cottons made a very rank growth, but the production was not very satisfactory, probably due to the excessive rainfall. The fertilizer experiments with cotton show that the three elements of plant food were needed, but more especially potash and phosphoric acid. It is estimated that from 6,000 to 7,000 acres were planted with sea-island cotton during the season. The two principal insect enemies of this crop at the present time are the cotton caterpillar (*Alabama argillacea*) and the cotton stainer (*Dysdercus suturellus*).

The results from seed corn from the States have not been promising. The only serious insect pest of the corn plant is the cotton bollworm (*Heliothis obsoleta*).

Of 5 varieties of potatoes from northern-grown seed the best results were obtained from Bliss Triumph and Early Rose. Some of the potatoes produced were shipped to San Juan and New York, and the indications are that under proper conditions potatoes may be grown commercially with success. Heavy fertilization and frequent spraying with Bordeaux mixture are recommended for successful potato culture.

Of the different forage crops grown the cowpea proved the most promising. Beggar weed made a fair growth, but did not reach the height it does on the light sandy soils of Florida. Velvet beans were not equal to the cowpea for a quick-growing crop. On properly drained and inoculated soil alfalfa made a promising showing. So far the clovers have not done well, and lupines and vetches have also failed to make satisfactory growth. The sugar beet was found subject to blight in the later stages of its growth. Turnips and kale in experimental plats did very well. Improved varieties of peanuts from the States gave good results at the station, while horse beans were practically a failure. Experiments with fiber crops are in progress, and the insular government has made provision for growing sisal on a commercial footing.

Report of the agriculturists, W. P. Brooks, F. R. Church, and S. B. Haskell, (*Massachusetts Sta. Rpt. 1905, pp. 15–43*).—The lines of work were the same as those followed in recent years (E. S. R., 17, p. 234). The experiments this season included 244 field plats, 150 closed plats, and 245 pots in vegetation experiments.

Mixed oats and peas were grown this year in connection with comparative tests of different sources of nitrogen, and on the basis of yields secured the materials ranked as follows: Nitrate of soda, dried blood, sulphate of ammonia, and barnyard manure. Based on the increase of all the crops since the beginning of the experiments the relative rank was: Nitrate of soda 100, dried blood 68.72, sulphate of ammonia 60.78, barnyard manure 80.58.

High-grade sulphate of potash was superior to muriate for clover, for rhubarb, and for blackberries. The different potash salts used as fertilizers for soy beans this season ranked as follows: Carbonate, high-grade sulphate, silicate, nitrate, muriate, low-grade sulphate, and kainit. The poorest results were obtained with kainit, the crop being much lower on the kainit plats than

on those which had received no potash for the past 8 years. In the experiments with a fertilizer mixture rich in potash and a special corn fertilizer the yields were practically equal, but the cost of the fertilizers was lower when the fertilizer rich in potash was used. The crop of this year was mixed hay.

In the comparison of a moderate application of barnyard manure alone with a smaller application of manure in combination with 160 lbs. of high-grade sulphate of potash per acre, the larger average yield was produced with the manure and the potash, and this combination also costs $6.40 less per acre than the larger quantity of manure alone. Mixed hay was also grown in connection with this test.

The spring application of barnyard manure gave the better yield in all cases, but the difference was not sufficient to cover the larger cost of the extra handling. There was little or no wash over the surface during the winter.

On the grass lands receiving different fertilizer treatment in rotation the average yield of hay was at the rate of 4,840 lbs. per acre for all 3 systems of manuring. The average yield in this test from 1893 to 1905, inclusive, was 6,479 lbs. An application of nitrate of soda, after harvesting the first crop of grass, gave but a relatively small increase in yield, but, in one instance, where applied at the rate of 150 lbs. per acre an increase of nearly 1 ton of rowen, or considerably more than sufficient to pay the cost of the fertilizer was obtained. The results in determining the relative value for garden crops with fertilizers supplying respectively nitrogen and potash, when used with manure, show that on the basis of total crops produced the standing of the differnet nitrogen fertilizers is, for the early crops, nitrate of soda 100, dried blood 95.67, sulphate of ammonia 63.08, and for late crops nitrate of soda 100, dried blood 98.77, sulphate of ammonia 79.52. For 15 years the relative standing of the fertilizers supplying potash is, for early crops, sulphate of potash 100, muriate of potash 94.66, and for late crops sulphate of potash 97.09, and muriate of potash 100.

A large number of experiments during the past 8 or 10 years indicate the doubtfulness of successful alfalfa growing in Massachusetts.

Illustrations of the influence of experiment station work on culture of field crops, J. I. SCHULTE (*U. S. Dept. Agr. Yearbook 1905, pp. 407–422, fig. 1*).—Specific instances are given of the improvements brought about in methods of farming and in the use of improved varieties of crops through the influence of the experiment stations. Shallow culture of corn, more careful seed selection, varieties adapted to special districts and purposes, heavier yields of oats, better varieties of cotton, the control of potato diseases, better methods in fertilizing and sweating tobacco, the development of the sugar-beet industry, the distribution of new varieties of sugar cane, the introduction of new forage crops, etc., are among the more important matters discussed.

Experiments with grain and forage plants, 1905, R. A. MOORE and A. L. STONE (*Wisconsin Sta. Rpt. 1905, pp. 330–355, figs. 5*).—The variety tests with grain and forage plants for the season were mainly conducted as in previous years. The results are briefly discussed and the data secured are presented in tables.

The Oderbruck and Mansbury barley were the most satisfactory varieties on trial. Oderbruck has now been grown for 7 years by the station, in comparison with 36 different varieties and improved by selection. In 1905 a yield of 58 bu. per acre, weighing 50 lbs. per measured bushel, was obtained, and on the average for the 7 years 53½ bu. per acre was secured. This variety has shown a protein content of 15 per cent. Mansbury barley grown in 66 cooperative tests

gave an average yield of 38.6 bu. per acre, or 6.7 bu. more than other varieties on trial.

Of 18 varieties of oats, Swedish Select, White Bedford, American Banner, and Wisconsin Wonder showed the most desirable characteristics. Sixty-day oats, one of the newer varieties, ranked first this season, with a yield of 66.8 bu. per acre. The Swedish Select oats are well adapted for uplands and seem to do better on poorer grades of land than other varieties tried. Their great root development renders them resistant to droughts. When grown on low rich soils they are likely to lodge and to fail to fill out.

Two varieties of winter wheat, Minnesota No. 550 and Beleglona, yielded 31.5 and 33.6 bu. of grain and 3.05 and 2.27 tons of straw per acre, respectively.

Through a series of 5 years, early varieties of soy beans gave yields varying from 20 to 40 bu. of beans per acre. Planted and cut with corn soy beans made an excellent silage, but were unsatisfactory when used alone. The plants were observed to develop nodules on their roots without inoculation when grown continuously upon the same ground for 3 years. With inoculation nodules were developed the first year. On rich land the effect of inoculation was not apparent, but it was very noticeable on the poorer grades of soil.

Four acres of sandy and clay loam soil were spring-plowed and sown with alfalfa at the rate of 20 lbs. per acre April 27, 1904. Barley sown at the rate of 1 bu. per acre was used as a nurse crop. A top dressing of well-rotted manure was applied in the fall of 1904 and in 1905 crops were cut June 12, July 13, and September 1, from which a total yield of 3¾ tons per acre was secured. In cooperative tests in 1904, 87 of 120 experimenters secured good stands of alfalfa, the common American variety doing as well as the Turkestan. From the results thus far secured it is concluded that under proper conditions alfalfa may be grown in practically all counties of the State.

Cooperative experiments with medium red clover have been in progress with this Department. Twenty-four, including 2 foreign varieties, were under test. Russian U. S. No. 12169 was exceptionally fine and yielded at the rate of 16.32 tons per acre of green forage and 3.64 tons per acre of well-cured hay. Four 1½-acre plats of Russian and American red clover were compared with a 3-acre plat of common medium red clover in 1905. The yields from these different plats varied from 1.7 tons for the common medium red to 2.2 tons for Russian No. 2.

The corn-breeding work of the station is carried on for establishing earlier maturing qualities in some of the later heavy-yielding varieties of yellow dent corn. In the breeding experiments Wisconsin No. 8, originally the Minnesota No. 13, was used as the male parent, with 8 other varieties for the female parent. These varieties were planted in 1904 and the progeny was tested in 1905. The result secured with each selected ear is shown in a table. Striking variations in the manner of growth and bearing qualities of the different ears manifested themselves. In a cooperative test of growing Silver King corn, for the purpose of selecting progeny of high-yielding ears for further trial, the rows, each representing a single ear, showed a variation in total yield of from 14 to 97 bu. per acre of shelled corn and an average yield of 58½ bu.

Fertilizer experiments were conducted with barley, sugar beets, oats, soy beans, and clover. Different combinations of commercial fertilizers were used. The beneficial effects were detected on the grain plats as soon as the plants appeared above ground. The clover showed no apparent difference between fertilized and unfertilized plats.

In treating barley with formaldehyde solutions for the eradication of smut, the general results indicated that solutions stronger than 1 pt. of formaldehyde to 20 gal. of water are likely to injure the germinating power of the grain,

especially when exposed to the solution for as long a time as 24 hours before sowing.

Wyoming forage plants and their chemical composition, H. G. KNIGHT, F. E. HEPNER, and A. NELSON (*Wyoming Sta. Bul. 70, pp. 75, pl. 1, figs. 31*).—The work here presented is in continuation of that reported in a previous bulletin (E. S. R., 17, p. 240).

The description and analyses of the following plants are recorded: Mountain wheat grass (*Agropyron violaceum*), rough hair grass (*Agrostis hyemalis*), Canada bent grass (*Calamagrostis canadensis*), marsh foxtail (*Alopecurus fulvus*), slough grass (*Beckmannia erucaeformis*), gramma grass (*Bouteloua oligostachya*), short awned brome grass (*Bromus marginatus*), Porter's brome grass (*B. porteri*), drop seed (*Sporobolus brevifolius*), reed meadow grass or manna (*Panicularia americana*), nerved manna grass (*P. nervata*), giant rye grass (*Elymus condensatus*), King's fescue (*Festuca kingii*), meadow barley or slender squirrel-tail (*Hordeum nodosum*), prairie June grass (*Koeleria cristata*), timothy (*Phleum pratense*), mountain timothy (*P. alpinum*), Nevada blue grass (*Poa nevadensis*), field sedge (*Carex marcida*), Liddon's sedge (*C. liddoni*), Nebraska sedge (*C. nebraskensis*), spike rush (*Eleocharis palustris*), long-styled rush (*Juncus longistylis*), thermopsis (*Thermopsis divaricarpa*).

Forage crops grown at Coast Land Experiment Station, W. D. GARRISON (*South Carolina Sta. Bul. 123, pp. 15*).—This bulletin gives the date of planting and harvesting and describes briefly the forage crops tested. The results are summarized in the following table:

Yields of forage crops at the Coast Land Experiment Station in 1905.

Crop.	Date of planting.	Date of harvesting.	No. of cuttings.	Yield per acre. Green.	Yield per acre. Dry.
				Lbs.	*Lbs.*
Alfalfa	....	May 30-Sept. 4	4	12,196	2,905
Cat-tail millet	Apr. 6	May 30-Sept. 28	6	94,424	....
Teosinte	Apr. 17	June 6-Sept. 29	6	43,923	....
Florida beggar weed	Apr. 21	July 1-Sept. 28	4	23,147	4,630
Berseem or Egyptian clover	Mar. 22	June 3	....	8,512	1,836
Mangel wurzels	Mar. 25	July 31	....	20,790	....
Early amber cane and Florida beggar weed.	July 18	Sept. 19	....	20,520	5,760
Early amber cane and Iron cowpea	Mar. 25	June 23, Sept. 4	2	81,238	37,097
Early amber cane and Newman bean	...do...	June, Sept. 4	2	72,226	33,500
Crimson clover	Oct. 31	May 2	....	14,850	3,600
Rescue grass	Oct. 24	Apr. 20-June 17	3	25,025	6,386
Wheat and hairy vetch	Oct. 31	May 13	....	16,329	7,732
Hairy vetch	...do...	May 11	....	15,838	3,184
Dwarf Essex rape	Nov. 2	May 1	....	11,161	....
Barley	Oct. 31	Mar. 15, Apr. 6	2	8,695	....
Rye	Nov. 10	.....do	2	12,712	....
Wheat, in beds	Oct. 24	Jan. 17-Apr. 19	3	16,120	....
Wheat, planted on level	...do...	.....do	3	12,524	....

Several varieties of cowpeas were planted June 3, 6, and 21. The yields varied from 8 to 15.9 bu. per acre. Iron cowpeas planted in rows 3 ft. apart yielded from 2,395 to 4,882 lbs. of hay per acre. A plat sown broadcast June 22 and harvested September 28 gave a yield per acre of 14,163 lbs. of green substance and 2,535 lbs. of hay.

Farm practice with forage crops in Western Oregon and Western Washington, B. HUNTER (*U. S. Dept. Agr., Bur. Plant. Indus. Bul. 94, pp. 39, figs. 4*).—This bulletin describes the methods of growing and handling forage crops in the Pacific Northwest by farmers who have been most successful in this line of work. A description of the region is given and notes on haymaking, the silo, and the value of leguminous plants are also presented. The crops discussed have

an important place in the agriculture of the region, and the methods of seeding, culture, and fertilization described are based almost entirely upon the prevailing farm practice. Red clover, alsike clover, common vetch, pearl vetch, field peas, alfalfa, timothy, the rye grasses, orchard grass, meadow fescue, velvet grass, Indian corn, rape, thousand-headed kale, root crops, and soiling crops are the crops treated of. A brief note is also given on seeding timber burns and burnt slashings.

Diversified farming in the cotton belt, W. J. SPILLMAN ET AL. (*U. S. Dept. Agr. Yearbook 1905, pp. 193–218, pls. 3*).—A series of articles is presented with a view to pointing out lines along which further progress in the diversification of crops along the South Atlantic coast, in Alabama, Mississippi, Louisiana, Arkansas, and Northeastern Texas, and Texas as a whole, may be made. A special study was made of each one of the regions mentioned and a separate report for each section is given.

The South Atlantic coast region is divided into agricultural sections, according as the different localities vary in character and crop production, and the agricultural practices for each section are briefly noted.

The observations made in Alabama and Mississippi led to the conclusion that the depletion and the washing away of the soil on southern farms may be prevented by establishing a system of farming which would increase the organic content of the soil. It is suggested that this may be done either by a system of crop rotation involving the use of leguminous crops and green manures, or by feeding a large portion of the crops on the farm and returning them to the soil as animal manures.

In the discussion on Louisiana, Arkansas, and Northeastern Texas, implements commonly used in the South are shown and described. Brief notes on their use, including the terms commonly applied to the different tools and operations, are given.

Summary of press bulletins (*Oklahoma Sta. Rpt. 1905, pp. 20–33, figs. 2*).—The subject-matter contained in this summary is largely reprinted from other publications of the station. Only the more recent results are here noted.

In the experiment with Bermuda grass (E. S. R., 17, p. 1062) a yield of 5,658 lbs. of cured hay per acre was secured in June, 1906. In September, 1905, less than 3 months after planting the ground with Bermuda grass sod 2,584 lbs. of hay was obtained, so that within less than a year 8,242 lbs. of hay was produced per acre.

Of different varieties of wheat tested Turkey red and Turkish red, believed to be the same, exceeded 25 bu. per acre in yield. Sibley New Golden, grown for several years on the college farm, stands first in average yield during a period of 5 years ending June 30, 1904. Some Northern varieties classed as spring wheats gave good results when sown in the fall in Oklahoma. The results during 3 years of pasturing wheat showed without variation that late spring pasturing is very detrimental to the crop. In 1905 a catch crop of soy beans was grown after wheat and a yield of 4.33 bu. of beans per acre was secured.

The business of seed and plant introduction and distribution, A. J. PIETERS (*U. S. Dept. Agr. Yearbook 1905, pp. 291–306, pls. 3*).—The history of seed and plant introduction and distribution by the Commissioner of Patents in former years and by this Department as his successor up to the present time is reviewed and the method of carrying on the work to-day is described. Estimates of the present annual value of some of the important crops introduced since the first appropriation in 1839 are presented. The crops and varieties included in this list are sorghum, Kafir corn, Durum wheat, Japanese Kiushu rice, Swedish select oats, Excelsior white Schonen oats, Chevalier barley, Fultz wheat, and the Washington navel orange.

Experiments on the germination of new harvested seed, C. EBERHART (*Fühling's Landw. Ztg., 55 (1906), No. 17, pp. 583–591*).—Samples of rye and wheat of different degrees of maturity were germinated by different methods, and the author concludes that germination in sand or between blotting papers is to be preferred to other methods.

Forcing the point of a pin into the smaller end of each grain had the effect of increasing the percentage of germination. Soaking the seed in water also increased the number of kernels which germinated. Both these treatments were unable to increase the percentage of germination and the rapidity of growth in wheat slightly immature. Treating the seed with ether had a favorable effect on its germination.

In general it was found that the germination of new harvested seed is governed by its degree of maturity. A sample of dead ripe rye showed a germination immediately upon harvesting, which the same grain, harvested in the milk stage, did not show until it had been stored for 40 days.

The effect of inbreeding in plants, A. D. SHAMEL (*U. S. Dept. Agr. Yearbook 1905, pp. 377–392, pls. 3, fig. 1, dgm. 1*).—This article defines the term inbreeding and discusses the use of inbreeding in the improvement of animals, the different degrees of inbreeding in plants, and its effect on their vegetative vigor and fertility.

The beneficial effects of inbreeding in tobacco and the detrimental effects of inbreeding in corn are discussed. It is stated that inbreeding in tobacco is an effective means of maintaining desirable characteristics in the established varieties, while cross-fertilization within the varieties reduces uniformity and decreases vigor. A method of corn breeding to avoid inbreeding is described and illustrated. The author inclines to the belief "that the improvement of our crops can be most rapidly effected with permanently beneficial results by following the practice of inbreeding, or crossing, to the degree in which these methods of fertilization are found to exist naturally in the kind of plant under consideration."

The breeding of cereals by means of artificial crossing, E. TSCHERMAK (*Ztschr. Landw. Versuchsw. Österr., 9 (1906), No. 6, pp. 699–743, pls. 2*).—The author's work and its results are described at some length. The following crosses are enumerated as obtained in addition to those of wheat and rye: *Secale cereale* × *S. montanum*, *Aegilops ovata* × *S. montanum*, *A. ovata* × *S. cereale*, *Hordeum distichum* × *H. spontaneum*, *H. tetrastichum* × *H. spontaneum*, *H. trifurcatum* × *H. spontaneum*, *A. ovata* × *Triticum vulgare*, and *Hordeum sp.*, with *Elymus europaeus*.

In crossing rye, xenia, with reference to color of seed, was observed in several cases. An increasing tendency to vary in the two crost forms seemed to favor the appearance of xenia in the crosses secured, contrary to the opinion of certain investigators. When species of rye with different types of heads were crossed, the female parent was neither alone nor most prominent in exerting its influence on the product and its progeny. Natural crosses resulted where different species of rye were grown in alternate rows. In about one-half of the plants of the first generation of rye crosses the type of head and form of seed of the male parent was prevalent, while in the other half the same characters of the female parent predominated. In the second generation the individuals split up into groups, showing the type of head of either the one parent or the other, or of both together. One-fourth of the number of individuals showed the spike characters of the female parent, one-fourth those of the male parent, and one-half were intermediate.

Crosses of winter and spring varieties of rye, when grown as spring varieties, show a medium period of growth, and spring rye as the prevailing type in the

first generation. In the second generation the proportion of individuals of the spring type to those of the winter form, at the time of heading, was as 2.5:1, while in the third generation the proportion raised to 3.4:1. Winter culture of the first generation reduced the spring form to the proportion of 1.34:1, and this influence was still noticeable in the third generation. Summer culture of the second generation increased the proportion of the spring type to more than 3:1, but winter culture of the second generation reversed the proportion to 1:9.49.

The author concludes that not only morphological, but also adaptive characters are capable of showing transmission according to Mendel's law. He also found that the cultivated and wild forms of the cereals cross readily, and that the tribe Hordeae is especially disposed to cross breeding.

The feeding value of soiling crops at different stages of growth, H. VON FEILITZEN (*Svenska Mosskulturför. Tidskr., 20 (1906), No. 1, pp. 72–77*).—A mixture of field peas, oats, and barley was grown on well decomposed marsh soil, and three cuttings were made, the first at the beginning of bloom and the second and third 10 and 20 days later, respectively. The largest yields of green forage, protein, carbohydrates, and other food ingredients were obtained in the last cutting, although the percentage content of the different constituents was highest in the first cutting. It is recommended to cut leguminous soiling crops when they have reached full bloom, as at this period the yields of both dry matter and nutrients are much higher than at earlier stages.—F. W. WOLL.

Alfalfa as a forage crop of Pennsylvania, G. C. WATSON (*Pennsylvania Sta. Rpt. 1905, pp. 74–86*).—The culture and fertilizer tests with alfalfa at the station for a series of years are summarized.

In the experience of the station alfalfa grew in a compact, gravelly soil with good drainage quite as well as in a loose loam. Heavy applications of phosphoric acid and potash were very effective in improving the growth of the crop, but 5 tons of barnyard manure per acre gave better results than the phosphoric acid and potash contained in 500 lbs. of a good brand of commercial fertilizer. Turkestan alfalfa did not appear as valuable as the common alfalfa. It is stated that fall-seeded alfalfa on dry land will withstand severe winters in Pennsylvania better than the common red clover. Where alfalfa grew vigorously from the start nodules appeared on the roots, but where the growth was weak and slow few plants were provided with them. Lime was in no case applied to advantage. In several instances alfalfa withstood the first winter, but was completely killed out during the second.

Inoculation experiments with alfalfa and soy beans, H. L. RUSSELL and R. A. MOORE (*Wisconsin Sta. Rpt. 1905, pp. 242–261, pl. 1, figs. 6*).—In the experiments reported the seed was first disinfected and then inoculation was brought about by the use of soil from previously cultivated alfalfa and soy bean plats and by the use of bacterial cultures. The tests were made under greenhouse and field conditions.

Field peas were also included in a part of the tests. The work was carried on for 2 seasons and the results seemed to warrant the conclusion that the necessary nodule-producing organism for the field pea is sufficiently abundant in the soils tested to make inoculation unnecessary. With alfalfa the inoculation with soil emulsions or soil scattered broadcast over the plats was more effective than the use of bacterial cultures. Soil from sweet clover fields or emulsion made from the sweet clover nodules was effectively used for the inoculation of alfalfa. The use of bacterial cultures had no effect on the soy bean, while seed infected with soil from an old soy bean field formed numerous nodules.

The improvement of corn in Pennsylvania, D. C. WING (*Penn. Dept. Agr. Bul. 133, pp. 76, figs. 18*).—This bulletin is a general treatise on corn and its culture. Special attention is given to the improvement of the crop with the hope of producing better varieties and better yields in Pennsylvania. The results of experiment station work have been largely drawn upon in its compilation.

Eureka silage corn—its value for Massachusetts farmers, J. B. LINDSEY and P. H. SMITH (*Massachusetts Sta. Rpt. 1905, pp. 86–93*).—Eureka silage corn, a late dent variety, was compared with Sibley Pride of the North, a medium dent maturing at the station.

In 1903 and 1904 Eureka grew 11 to 13 ft. high and when cut September 15 the ears were very immature and the whole plant contained about 6 per cent more water, more ash and fiber, and less extract matter than Sibley Pride of the North. The field-cured fodder of Eureka contained 69 per cent of water and that of Pride of the North only 38 per cent. The green and dry fodder of Eureka were found to be 67 and 64 per cent digestible, respectively, while Pride of the North cut green was 71 per cent digestible. The Eureka produced 64 per cent of stalks and 7 per cent of ears and Pride of the North 47 per cent of stalks and 22 per cent of ears. The yields of green fodder were 20 and 13 tons per acre, respectively, for Eureka and Pride of the North, but in actual food material produced the 2 varieties were nearly equal.

Variety and distance tests of corn and cotton, B. W. KILGORE ET AL. (*Bul. N. C. Dept. Agr., 27 (1906), No. 2, pp. 64*).—A record is given of the year's work on the North Carolina agricultural department test farms.

The results of variety tests for the past 5 years show that Cocke Prolific is a most substantial and reliable variety of corn and one of the best on the sandy loam soils of the eastern part of the State. This variety from home-grown seed ranked second in 1900, 1901, 1904, and first in 1902, 1903, and 1905 at the Edgecombe farm. The data obtained at the different farms with all the varieties varied considerably. Notes on the different varieties grown are given and the sources of the seed used are listed. As indicated by an average of 5 years' results corn on the Edgecombe farm should be planted 4 by 3 ft., and on the Iredell farm, as indicated by 3 years' results, 5 by 2 ft.

Russell Big Boll cotton, on an average for 6 years, has ranked first among a number of varieties according to value of total crop, being followed by Culpepper Improved and Peterkin Improved. The different varieties are noted, and the sources of the seed used in 1905 are listed. The distance experiments at the Edgecombe and Red Springs farms during the past 4 years favored a spacing of 3½ ft. by 16 in. for the Edgecombe section and of about 4 ft. by 60 in. at Red Springs, while a three years' test at Iredell farm showed best results from planting 4 ft. by 24 in.

Cotton experiments, C. L. NEWMAN (*South Carolina Sta. Bul. 120, pp. 19*).—A number of fertilizer and variety tests with cotton are reported.

In one series of fertilizer tests cow manure and stable manure, with and without phosphoric acid and potash, and cotton-seed meal and hulls, with and without phosphoric acid and potash, were compared. The fertilizing constituents, from a chemical standpoint, were the same in quantity in the different applications. The largest yield of seed and lint per acre, being 664 and 332 lbs., respectively, was secured on a plat receiving 2,960 lbs. of stable manure, 192 lbs. acid phosphate, and 99 lbs. kainit. The average yield of seed cotton from the 2 plats receiving cow manure was 427 lbs. per acre, and from the plats fertilized with cotton-seed meal and cotton-seed hulls 260 lbs. per acre, showing that the meal and hulls after having served their purpose as a cow feed and converted into a fertilizer produced an increase in yield of 64 per cent over their direct application to the soil.

In another series of tests, comparing cow manure with compost, the quantities applied being based on the chemical analyses, the best yields amounting to 666.6 lbs. of seed and 333.3 lbs. of lint per acre, were secured from the use of 2,640 lbs. of compost per acre. This plat gave 82 lbs. more lint per acre than a plat which had received 5,428 lbs. of cow manure and 272 lbs. of acid phosphate.

In a third series of experiments, with the use of commercial fertilizers alone and in combination, an application of 1,360 lbs. of acid phosphate and 320 lbs. nitrate of soda per acre stood first in yield, with 754.7 lbs. of seed and 377.3 lbs. of lint per acre. This plat also ranked first in early maturity, 94 per cent of the crop being gathered by September 28. The effect of acid phosphate in hastening maturity was noticed in the results secured. A home mixture, applied at the rate of 595 lbs. per acre, containing 1.6 per cent of phosphoric acid, 0.64 per cent of potash, and 0.54 per cent of ammonia less than Peruvian guano, gave an average of 43.8 lbs. of seed cotton more per acre than the guano, which was given at the rate of 500 lbs. per acre.

The results with a number of varieties of cotton compared by the station during a series of years are compiled and presented in tables. It is shown that Texas Oak led in yield twice and ranked third once, Crossland stood third once, Bates' Improved Prolific ranked first once and second once, Doughtey's Long Staple and Jackson Limbless each stood second once. Peerless ranked second and third once, and Drake Cluster and Texas Burr were each third once.

The Aldrich system of growing cotton and corn, which consists in growing the cotton rows and corn rows alternately in pairs throughout the same field, was compared with 2 check plats, one in cotton and the other in corn. The cotton check produced 1,599.2 lbs. of seed cotton per acre, worth $72.60, and the corn check 36 bu. of corn per acre, worth $21.60, or a total of $94.20 for 2 acres. The plat grown by the Aldrich system produced an aggregate value of $13.58 less than the check plats, or $6.79 less per acre.

The cultivation of maguey in the Philippine Islands, H. T. EDWARDS (*Philippine Bur. Agr. Farmers' Bul. 13, pp. 25, pls. 9*).—A general account is given of the history and distribution of maguey in the world and in the Philippine Islands. The plant is described, its climatic and cultural requirements noted, and its value and uses pointed out. In connection with directions for harvesting, a description of the extraction of the fiber and fiber-extracting machinery is presented.

Composition of soy beans, W. FREAR (*Pennsylvania Sta. Rpt. 1905, pp. 39, 40*).—The composition is reported of the grain of Cross Bred No. 6, Early Black, Ita San, and Early Green soy beans.

The conclusion is drawn from the data that for seed the Cross Bred No. 6 and the Early Black are the safer varieties in the more elevated and northern part of Pennsylvania, and that Ita San and Early Green, which are early enough for the southern and less elevated portions of the State, are preferable for that region on account of the size of the plants and their productiveness. None of these varieties gave a yield of 35 bu. per acre, which was secured by the Massachusetts Station from the Medium Early White variety.

Experiments with sugar beets, season 1905, F. W. WOLL, R. A. MOORE, and A. L. STONE (*Wisconsin Sta. Rpt. 1905, pp. 356–362, dgm. 1*).—Variety, fertilizer, and culture tests were made.

In the variety test the highest yield, 15,631 lbs. of beets per acre, was secured from Breustedt Kleinwanzleben. The yields of beets and of sugar from Breustedt Kleinwanzleben, Schlanstedt Kleinwanzleben, and Heine Kleinwanzleben were above the average for the entire field. The sugar content of the beets ranged from 16.4 per cent in Hoerning to 17.7 per cent in Schaefer. The use of a complete fertilizer in growing sugar beets showed a marked improvement

both in the yield and the quality of the beets produced. The yield of beets was increased by 41.9 per cent and the yield of sugar by 47.3 per cent over the check plats. An acre of sugar beets grown for factory purposes yielded 23,065 lbs. of beets, or about 3,863 lbs. of sugar per acre. The sugar content for the entire field was 16.75 per cent and the purity 88.7 per cent.

Dark fire-cured tobacco of Virginia and the possibilities for its improvement, G. T. McNess and E. H. Mathewson (*U. S. Dept. Agr. Yearbook 1905, pp. 219–230, pls. 4, fig. 1*).—An article dealing solely with the dark tobacco of Virginia and treating expressly of the conditions existing in the district where this crop is produced.

The history of tobacco culture in the State is briefly reviewed, the types of leaf described, the common methods of cultivation, curing, and marketing discussed, and improvements in the different lines suggested. Notes are also given on the selection of soils, the making of seed beds, and the use of fertilizers.

In 1904 the Bureau of Soils began a series of experiments in Appomattox County with the object of determining by practical commercial tests what may be accomplished in these older tobacco-growing sections. An acre of land was fertilized after the usual farmer's method with 400 lbs. of fertilizer, costing $5 an acre, and furnishing 12 lbs. of ammonia, 36 lbs. of phosphoric acid, 12 lbs. of potash. A second acre plat was fertilized wtih 850 lbs. of home-mixed fertilizer, costing $16.44, and containing 73½ lbs. of ammonia, 57 lbs. of phosphoric acid, and 75 lbs. of potash, and a third acre plat received 1,700 lbs. of home-mixed fertilizer, costing $32.30, and giving 153 lbs. of ammonia, 106 lbs. of phosphoric acid, and 125 lbs. of potash. The acre fertilized after the usual farmer's method yielded 673 lbs. of tobacco, which sold for $45.50 gross, or an average of 6¾ cts. a pound. The second acre plat produced 883 lbs., selling for $81.09, or an average of 9¼ cts. a pound, and the third acre plat yielded 1,334 lbs., which sold for $111.29, or 8⅖ cts. a pound. To keep the product of the plats uniform the number of plants set per acre was 4,200, 5,000, and 6,000, respectively, and the net profit mentioned in the order given was $5, $21, and $29.

The composition of turnips and swedes, J. Hendrick (*Trans. Highland and Agr. Soc. Scot., 5. ser., 18 (1906), pp. 281–296, figs. 2*).—The work in Great Britain during recent years on the composition of turnips and swedes with a view to their improvement is summarized.

It was found that the upper half of the turnip and the outer portion contained a higher percentage of dry matter than the lower half and the inner portion. The determinations were made on sound and hard roots and the results are considered as probably not holding with dry roots, consisting largely of soft, spongy tissue. It is believed that by selection the composition of root crops may be improved.

Winter wheat, A. T. Wiancko and M. L. Fisher (*Indiana Sta. Bul. 114, pp. 291–308*).—This bulletin summarizes the results secured with the varieties of winter wheat grown by the station since 1900.

In comparing the varieties Michigan Amber of home production was taken as the standard, the average yield for this variety for 6 years being 30.5 bu. per acre. Among the varieties seeming most promising or reliable at present are mentioned Rudy, Mealy, Tennessee White Fultz, Winter King, and Farmer's Friend. Dawson Golden Chaff and Gold Coin also gave good yields. Tennessee White Fultz, Dawson Golden Chaff, and Gold Coin have shown themselves to be very hardy, strong in straw, and good yielders, but they are all white and rather soft wheats and are, therefore, not recommended for milling qualities. The Hungarian and Russian varieties, including Gluten, Gluten B 86, California, Kharkov, Beloglino, Turkish Red, Buda Pesth, and Ghirka Winter were all very hardy, more or less rust resistant, and of excellent milling quality, but

extremely weak in the straw. Of the varieties having a 5-year record, Tennessee White Fultz, Winter King, Red Cross, Gluten B 86, Beechwood Hybrid, and Buda Pesth ranked first in the order given and their yields exceeded the yield of the standard variety by 27 bu. for Tennessee White Fultz and by 9.4 bu. for Buda Pesth.

Notes on winter-wheat culture are given, the value of crop rotation, and the relative effects of fertilization in good and poor wheat seasons are pointed out. In rotation experiments, which have been in progress on the university farm for 18 years, the continuous grain-growing plats in 1906 gave an average of 20.6 bu. per acre, as compared with 26.6 bu. per acre for rotations with clover. A rotation of corn, oats, wheat, and clover gave an average return for the 3 last wheat crops of 21.1 bu. per acre, while a rotation of corn and wheat gave but 16.9 bu. In the fertilizer experiments it was observed that the beneficial effects were very much greater in the poor seasons than in the good seasons, and that the average gains produced were 5 bu., or 116 per cent greater.

The flinty condition of wheat, F. R. Ferle (*Fühling's Landw. Ztg., 55 (1906), No. 14, pp. 492–494*).—Two samples of flinty wheat which had been brought from the vicinity of Algiers in 1898 and kept in ordinary glass bottles were sown in the spring of 1905. These samples showed a germination of about 30 per cent. In the crop produced by one of the samples the normally developed grains were all flinty, and in the other sample the degree of flintiness was even greater than in the original seed. The author points out that while a reduction of the vegetative period through the lack of moisture and with an excess of light and heat wheat has a tendency to become flinty, the greatest and most important factor in the production of flinty kernels is inherent in the variety and is transmitted. He further states that a variety of a flinty character will retain its flintiness for a long time, even if grown under conditions unfavorable for the production of flinty grain.

HORTICULTURE.

[Horticultural investigations in Alaska], C. C. Georgeson (*U. S. Dept. Agr., Office Expt. Stas. Bul. 169, pp. 27–39; 51–54; 58–60; 63–65; 66–91, pls. 2*).—Notes are given on the results secured at the Alaska experiment stations located at Sitka, Copper Center, Rampart, and Kenai, in the culture of various vegetables, orchard and small fruits, and flowers. Large quantities of seed were distributed to all parts of the Territory, and the reports of many persons who planted these are incorporated.

Report of the horticulturist, H. C. Henricksen (*U. S. Dept. Agr., Office Expt. Stas. Bul. 171, pp. 23–41, pls. 2*).—This is the report of the horticulturist of the Porto Rico Experiment Station for the year 1905. It gives a general outline of the work done at the station during the year with citrus fruits, pineapples, mangoes, rubber, vegetables, and about 50 miscellaneous tropical plants.

Report of the horticulturist, F. A. Waugh (*Massachusetts Sta. Rpt. 1905, pp. 47–49*).—Further notes are given by the author on the behavior of the winter-injured peach trees receiving (1) no pruning; (2) moderate pruning; (3) severe heading back, and (4) cutting back to stubs or dehorning (E. S. R., 17, p. 248).

The general conclusion of the preceding year, that moderate pruning is to be preferred for winter-injured peach trees, still stands, "though the severely pruned trees made a relatively better showing under the stress of a good crop of fruit." The results of the experiment, as a whole, indicate that when the wood has been injured by freezing peach trees should be moderately pruned, removing not more than one-third to one-half the previous year's growth.

"When only the fruit buds are killed, the wood being uninjured and the trees in good condition, prune severely, cutting back the annual growth to two or three buds. It may be expedient to cut some branches back even into two or three year old wood."

Horticultural work (*Oklahoma Sta. Rpt. 1906, pp. 36–43*).—Notes are given on storing sweet potatoes, small fruits (E. S. R., 17, p. 664), and planting trees for posts, wood, etc.

The fundamental conditions for success in storing sweet potatoes are stated to be potatoes healthy and free from bruises and cuts, dry when stored, and kept dry while in storage, and the maintenance of temperature of the storage room between 50 and 65° F. One method of storing the potatoes is to keep the temperature of the storage room up to 90° for about a week as soon as the potatoes are stored, giving good ventilation. Where this process is not convenient the tubers should be given all the ventilation possible, so they can dry very rapidly for about 2 weeks.

The book of market gardening, R. L. Castle (*London and New York: John Lane Co., 1906, pp. 171, pls. 14, figs. 6, dgms. 5*).—This book discusses the business aspects of market gardening, dealing with the selection of land, labor questions, crops, preparation of produce for sale, grading, packing, marketing, cooperation, taxes, crop returns, values, etc. This is volume 27 in the series of Handbooks of Practical Gardening, edited by H. Roberts.

Excessive feeding as a factor in producing variation in tomatoes, E. P. Sandsten (*Wisconsin Sta. Rpt. 1905, pp. 300–314, figs. 11*).—An account is given of the variations obtained with the variety Spark's Earliana when the soil in the greenhouse bed in which they were grown was fertilized with nitrate of soda at the rate of 800 lbs., sulphate of potash 600 lbs., and desiccated bone 1,000 lbs. per acre.

The variations obtained by this excessive amount of fertilizers were as great as those commonly observed in different varieties. Many of the modifications in flower, foliage, and fruit are illustrated. Cuttings of the different plants, when rooted and transplanted to the open field, reproduced the variations observed in the greenhouse, and the writer is of the opinion that this method of producing variation in plants by excessive feeding may play a very prominent part in the securing of new varieties of plants.

Rhubarb culture, Kunath (*Arb. Deut. Landw. Gesell., 1906, No. 117, pp. 12–44, figs. 5*).—An extensive account is given of rhubarb culture in Germany, with analyses with reference to food and fertilizer constituents and suggestions on the preparation of rhabarb for the table. Considerable data are given on the yields secured in experiments with different varieties of rhubarb and on the extent to which rhubarb is grown in different sections of Germany.

Rhubarb culture in England, B. Skalweit (*Arb. Deut. Landw. Gesell., 1906, No. 117, pp. 45–51*).—An account of the commercial culture of rhubarb in England, including directions for fertilizing rhubarb and a brief bibliography on the subject.

New fruit productions of the Department of Agriculture, H. J. Webber (*U. S. Dept. Agr. Yearbook 1905, pp. 275–290, pls. 7, fig. 1*).—Descriptions are given of a new citrange, 2 new limes, and 5 new pineapples originated under the author's direction.

The new citrange has been named Morton and is sweeter than either the Rusk or Willits, less bitter and almost seedless. It has resisted cold which has greatly injured other oranges, and it is believed that it can be grown from Tennessee and Arkansas southward and near the coast in Oregon and Washington. It will be chiefly useful as a breakfast fruit and for the preparation of citrangeade. The two new limes have been called Palmetto and Everglade.

Both are improvements over the limes usually grown in Florida. The varieties of pineapple have been called Miami, Seminole, Eden, Matthams, and Gale. Illustrated descriptions are given of each, with an account of its origin. All are remarkable for their superior flavor.

Promising new fruits, W. A. TAYLOR (*U. S. Dept. Agr. Yearbook 1905, pp. 495–510, pls. 9*).—Historical notes and illustrated descriptions are given of the Virginia Beauty and Carson apples; Crocker pear; Everbearing peach; Golden plum; Riley, Scioto, and Pringle Damson plums; Eulalia loquat, Hollis, Moneymaker, Schley, and Success pecans, and Trapp avocado.

The relation of early maturity to hardiness in trees, R. A. EMERSON (*Nebraska Sta. Rpt. 1905, pp. 101–110, figs. 13*).—The author states "that resistance to cold in trees is due often almost wholly to the habit of early maturity rather than to constitutional hardiness." That early maturity and hardiness is in a large measure a matter of variety is brought out in a number of illustrations showing the difference of maturity in fall of different varieties of plums and apples. Young trees also grow longer in the fall than old trees, as a consequence of which the wood is less matured and the trees are more subject to injury from cold than older trees.

Data and illustrations are given for black walnut and honey locust trees, showing that trees grown from seed from a southern locality grow longer in the fall and enter the winter in a more sappy and green condition than the trees grown from seed obtained farther north. The hardiest trees of black walnut were grown from seed obtained from South Dakota. Natural late growing trees can be forced into early ripening by planting on high land instead of low ground and by the use of cover crops planted in midsummer, which dry out the ground enough to check growth of the trees and thus force them to ripen their wood before winter. By the use of cover crops late growing varieties were made to stop growth from a few weeks to 2 months earlier than similar trees in adjoining plats given late cultivation.

Conditions which affect the time of the annual flowering of fruit trees, E. P. SANDSTEN (*Wisconsin Sta. Bul. 137, pp. 21*).—The author made a study of the interrelation of climatic conditions to the time of flowering of a number of orchard fruits. Tabular data are given showing the blooming period for the years 1899–1905 of 26 varieties of plums and 25 of apples, and of the principal climatic features during each of these years.

It has been held that a definite number of heat or temperature units are required for a given species to come into bloom, and this has been termed its "physiological constant." The author shows that the relation between temperature and time of flowering of apples and plums in different years is too wide and variable to be used as a basis for calculating a physiological constant, especially if the spring temperature only is considered. In 1902 plums did not bloom until the average of 762 positive heat units had been received in the spring, while in 1901 they bloomed after receiving but 601 units. If, however, the positive temperature unit be reckoned from the preceding July—a period covering the entire development of the flower bud—instead of January, it is shown that the flower buds of 1901 received a total of 4,487 units, or 450 to 500 more than the flower buds of 1902 received.

A number of factors other than temperature were also found to influence the time of blooming. A heavy fruit crop retards the development of flower buds and delays blossoming. The distribution of the heat and rainfall during the growing season, soil conditions, and health of the trees are also factors. If these factors are eliminated "it seems reasonable, from the evidence presented [that], a physiological constant can be formulated from the climatic conditions during the 10 months preceding the time of flowering."

New opportunities in subtropical fruit growing, P. H. ROLFS (*U. S. Dept. Agr. Yearbook 1905, pp. 439–454, pls. 3, figs. 4*).—The author discusses the uses and culture of the avocado, mango, sugar apple, ceriman, and guava.

The handling of fruit for transportation, G. H. POWELL (*U. S. Dept. Agr. Yearbook 1905, pp. 349–362, pls. 4*).—A discussion is given of the requirements of fresh fruits as regards harvesting, packing, cooling, and transportation to prevent molds, rots, and decay.

Owing to improvements in transportation facilities, fruits grown in California and the Southern States are shipped to Eastern and Northern markets in a fresh condition. Frequently large losses occur, due to shipping fruit too warm or in rough handling, both of which greatly favor the development of fungus diseases.

Mechanical injuries to the fruit may be caused by the puncture of insects, by the stem of one penetrating the other, finger-nail cuts, dropping the fruit on sharp surfaces, clipper cuts, etc. Some pickers may injure only 1 per cent of the fruit in gathering, while others may injure as much as 50 to 75 per cent. Any abrasion of the skin forms a lodging place for spores, which rapidly develop in warm, moist air, resulting in decay.

Factors which favor long keeping qualities are cold, dry, pure air, sound fruit, wrapping, cooling after it is picked, and shipping in comparatively small packages which cool quickly throughout. A free circulation of air should be maintained about the packages. Where possible fruits should be cooled before putting into refrigerating cars for shipment. Fruit allowed to stand until morning may be 20 to 40° cooler than when picked in the afternoon. The use of salt and ice in refrigerator cars will produce a lower temperature than the use of large cakes of ice alone.

It requires from 4 to 7 days for fruit in barrels held at 32° F. to cool down to a uniform temperature of 32° F. A longer time is required where the fruit is wrapped. The protection of the wrapped fruit, however, against bruising usually outweighs the disadvantage of slower cooling. While immediate cooling after picking and transportation in refrigerator cars will prevent the development of rots during transportation, such fruits if roughly handled, bruised, or cut in any way in harvesting will decay very promptly when offered on the market.

Small fruits in 1904, J. P. PILLSBURY (*Pennsylvania Sta. Rpt. 1905, pp. 198–206*).—Tables are given showing the usual annual data (E. S. R., 17, p. 254) relative to the date of flowering, ripening, rust resistance, vigor, yield, and size of a large number of strawberries grown in 1904, and the average weight of the berries during a period of 9 years. Similar data are given for a large number of varieties of raspberries, blackberries, currants, and gooseberries grown at the station.

Cranberry investigations, A. R. WHITSON, L. P. HASKINS, and O. G. MALDE (*Wisconsin Sta. Rpt. 1905, pp. 282–299*).—An account is given of further progress in the cranberry work at the station previously noted (E. S. R., 16, p. 778). In the experiments of 1905 the holding of the winter's flood on the plants up till May 21, instead of April 21, resulted in later blooming and later harvests. Improving the soil by weeding, sanding, and drainage has resulted in warmer soils and less danger from frosts.

A table is given showing the maximum and minimum temperatures on different plats, from July 22 to September 16. It is shown that low temperature of the marshes is "due to radiation from the surface through the air above, producing lower temperatures than that of the general mass of the atmosphere a short distance above." The difference in temperature in the vines at the ground surface and 3 ft. above averaged 5.22° over a period of 58 days.

In the experiments in draining the marsh to different depths practically the

same yields were obtained in 1904, whether the water was held at the surface, 4 to 8 in. below the surface, or 14 in. below the surface. In 1905 the heavier yields were obtained on the more thoroughly drained plats.

Data are given showing the relation of frost formation to humidity, rainfall, and evaporation, and the seepage in reservoirs. Covering plats from 1½ to 2 in. deep with sand reduced the yield of fruit the first year, but resulted in a very vigorous growth of vines. The cost of sanding, when the sand was hauled 1¾ miles, was at the rate of 40 cts. per yard.

To determine the effect of lime carbonate on cranberries, a plat containing about 8 sq. rd. was treated with 500 lbs. of air-slaked lime. The first season the vines on this plat grew as well as those on adjacent plats, but the next year the vines on this plat remained red throughout the summer, showing no growth whatever, and many died out entirely. It is believed these results indicate that hard water would be fatal to the growth of the cranberry.

A number of experiments were made with fertilizers, from which it appears that the use of a mixture of about 250 lbs. acid phosphate, 75 lbs. nitrate of soda, and 75 lbs. of sulphate of potash per acre each year might be profitable on vines in heavy bearing. The application should be made soon after the winter's flood is withdrawn.

Good results were obtained in the planting of new bogs by scattering the vines before the ditches were dug. The soil from the ditches was then pulverized and mixed into thick mud and poured over the vines in small ridges about 1 ft. apart. While wasteful of vines, this method resulted in more rapid growth than on unsanded bogs. Good results were also obtained by planting cuttings in rows on sanded bogs. Also in planting on narrow ridges about 2½ ft. wide and 1 ft. high.

Observations on the keeping qualities of green and ripe fruit showed that when berries were picked September 8, the following April 36.5 per cent were sound; when picked on September 24, 46.9 per cent, and on October 8, 44.2 per cent were sound.

Notes are given on the cranberry fruit worm and on the value of flooding the vines as a means of control. The investigations on cranberry blight indicate that the amount of blight is largely controlled by the vitality of the vines.

Tannic acid as a fertilizer for grapes, L. E. Cavazza (*Italia Agr., 43 (1906), No. 16, pp. 390–392, figs. 3*).—A general discussion is given of the utilization of organic material by vegetables, with an account of the use of tannic acid and tannate of iron as a fertilizer for grapes. The results secured are not conclusive, but indicate that tannic acid, if not in excess, is not harmful to vegetation, and in the form of tannate of iron resulted in considerably better growth of vines than where nothing was added.

Report of the coffee specialist, J. W. Van Leenhoff (*U. S. Dept. Agr., Office Expt. Stas. Bul. 171, pp. 42–47, pls. 2*).—This report covers the work done at the Porto Rico Experiment Station for the year 1905.

A large number of varieties of coffees have been imported from different sections of the world and planted, extensive plantings of Porto Rico coffee made, and experiments in the improvement of an old coffee grove begun. The cost of preparing and planting an acre of land for coffee was found to be about $60. The yield of coffee obtained on several experimental plats, differently fertilized, is given. Various diseases and insect pests which affected the crop during the year are briefly noted.

Cross pollination of almonds, J. P. Dargitz (*Pacific Rural Press, 72 (1906), No. 10, p. 147*).—The author gives an account of the bearing of 300 acres of almonds planted with different varieties.

The I X L variety has yielded but one fair crop, though the trees are 17 years old. When planted in alternate rows with Drake Seedling or Texas Prolific, they have borne quite regularly and heavily. Both the Drake and Texas Prolific bear regularly and well. When Nonpareils were planted in alternate rows with I X L the results have been unsatisfactory. The Texas seems to be a much better pollenizer for the Nonpareil than any other variety. At present all I X L trees are being worked over to Texas Prolific, and the author states that if planting out a young orchard he would plant Nonpareils and Texas Prolific in alternate rows, or Drake Seedling and Texas Prolific in the same manner.

Progress in drug-plant cultivation, R. H. True (*U. S. Dept. Agr. Yearbook 1905, pp. 533–540, pls. 3*).—Popular descriptions and cultural directions are given for the growing of Golden Seal, Cascara Sagrada, Seneca snakeroot, purple cornflower, American wormseed, jimson weed, poke, burdock and yellow dock, Asiatic poppy, foxglove, and peppers as drugs. The demand for each of these is rather limited, and it is recommended that prospective growers in the beginning cultivate only small areas.

Hybrids and hybridization among bulbous plants, C. G. Van Tubergen (*Gard. Chron., 3 ser., 40 (1906), No. 1025, pp. 132–134*).—This is a paper presented before the Hybridization Conference in London, in which the author gives an account of some of the hybrids obtained with Lilium, *Brunsvigia josephinæ*, Colchicum, Eremurus, Freesias, Gladiolus, Hymenocallis, Iris, and Nerine.

Compilation of analyses of fruits, garden crops, and insecticides, H. D. Haskins (*Massachusetts Sta. Rpt. 1905, pp. 184–199*).—Compiled analyses with reference to fertilizing constituents are given for a large number of orchard and small fruits, grapes, and vegetables, including sugar beets, potatoes, corn, and tobacco, with a table showing the relative proportions of phosphoric acid, potassium, and nitrogen in vegetables, and analyses of 20 insecticides. The composition of 20 prominent garden crops shows on the average, in a thousand parts, nitrogen 4.1, potassium oxid 3.9, and phosphoric acid 1.9 per cent.

FORESTRY.

Administration report of the forest circles in the Bombay presidency, including Sind, for the year 1904–5 (*Admin. Rpt. Forest Dept. Bombay, 1904–5, pp. 170*).—The usual schedule reports are given showing the reserved, protected, and unclassed forests in the northern, central, southern, and Sind forest circles, with an account of the work of the year, etc. The appendices as usual show the detail of expenditures incurred in the different circles and receipts from different sources, the progress made in working plans, statement of forests surveyed, etc.

Reports on forest administration in Burma for the year 1904–5 (*Rpts. Forest Admin. Burma, 1904–5, pp. 173*).—An outline is given of the forestry work done during the year in each of the forest circles of Pegu, Tenasserim, northern, and southern, with a general summary of the same by the Chief Conservator of Forests, F. B. Bryant.

Under the subject of sylviculture it is stated that the natural reproduction of teak is generally scarce or even absent in areas which have been long protected from fire, and that where areas are annually burnt over reproduction is generally satisfactory. Selection fellings in moist forests under fire protection have not usually been followed by satisfactory teak reproduction.

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Forestry conditions in Canada, U. SCHECK (*Ber. Land u. Forstw. Auslande, 1906, No. 11, pp. 122, map 1*).—A popular account is given of the physical features, agriculture, and forestry conditions of the different provinces of Canada.

How to grow young trees for forest planting, E. A. STERLING (*U. S. Dept. Agr. Yearbook 1905, pp. 183–192, pl. 1, fig. 1*).—Directions are given for growing seedling forest trees from seeds planted in the nursery.

Conifer seedlings should be kept under partial shade for at least two years before transplanting. A shade made by spacing lath about an inch apart is about right. The lath shade framework should be about 18 inches high and erected as soon as the seed is put in the ground. After transplanting at two years of age seedlings will require no further shading. No shade is required for the broad leaf species, but such seeds as the locust, coffee tree, mulberry, and hackberry should be treated with water heated nearly to the boiling point and allowed to soak 4 or 5 days before planting.

Woodlot thinning, E. E. BOGUE (*Forestry and Irrig., 12 (1906), No. 8, pp. 385–388, fig. 1*).—A detailed account is given of the thinning of $\frac{7}{10}$ of an acre of woodland, showing the number and kinds of trees on the land, the number removed, the average diameter, etc.

The nascent forest of the Miscou beach plain, W. F. GANONG (*Bot. Gaz., 42 (1906), No. 2, pp. 81–106, figs. 14*).—An account of the forest flora of the island forming the northeastern angle of the Province of New Brunswick. In many respects, it is stated, the vegetation of this beach plain closely resembles that of the sand beaches and dunes of Lake Michigan.

Sugar pine and western yellow pine in California, A. W. COOPER (*U. S. Dept. Agr., Forest Serv. Bul. 69, pp. 42, pls. 4*).—The author discusses the range and distribution of the yellow and sugar pines, the species with which they are associated, various forest types, botanical characteristics of each, and methods of lumbering observed in California. He gives data showing the average number of trees and percentage of each species per acre at the various elevations in two counties of California, the rate of growth, and diameter and height of the trees, with suggestions for conservative methods of lumbering. Data are also given showing the character of the wood and the commercial importance of these trees in the West.

Yellow pine ranges from central British Columbia, east to the Black Hills, and south to Arizona and New Mexico, while sugar pine is limited to small portions of the Pacific mountains. The sugar pine is one of the most intolerant trees of the Sierra conifers. In its early growth, however, it is shade demanding, and may be stunted or even killed in full light. Tests indicate that not more than 25 per cent of the seed is germinable. The matured trees are very resistant to fires, being rarely killed.

Yellow pine can stand much more drought than sugar pine and is less demanding as regards soils. During early life it grows much more rapidly in both height and diameter than sugar pine, but at the age of 100 years is surpassed by the sugar pine, which attains to a greater height and diameter.

Sugar pine closely approaches eastern white pine in its physical characteristics and is used for practically the same purposes. The yellow pine is considerably heavier than sugar pine and proportionately stronger. In 1904, 289,000,000 ft. of yellow pine was lumbered in California and 128,000,000 ft. of sugar pine. Under present methods of lumbering but few companies cut trees under a diameter of 24 in. on the stump. The average cost of getting the logs to mill is placed at $5 per thousand, and it is estimated that few companies can place lumber on railroad tracks for less than $14 per thousand.

The general conclusion is drawn that conservative management of the sugar and yellow pine forests of California is practicable, and that the greatest ob-

stacle to securing a future crop of timber is fire. It is believed, however, that effective fire protection is possible at a reasonable cost.

Waste in logging southern yellow pine, J. G. PETERS (*U. S. Dept. Agr. Yearbook 1905, pp. 483–494*).—The author reports the results of an investigation of the waste in logging southern yellow pine when the timber is owned by one man but sold to and lumbered by another on a stumpage basis. The results of the investigations apply particularly to Mississippi, Louisiana, and Texas, where the cost of producing lumber is placed at $8 a thousand.

An examination was made of 8 cuttings. About 6 per cent of the trees left standing were found to be part merchantable culls. Of the trees which should have been left standing for future crops, about 25 per cent were broken down or otherwise destroyed by careless logging. The amount of waste in the top logs, where 16 feet is assumed to be the shortest merchantable log length, was 667 feet per acre, and where 12 feet is thus assumed, 962 per acre, the market value of which was $9.92 per 1,000 feet.

The waste in cutting sound stumps high was found to be 218 board feet per acre, or 1.85 per cent of the total yield. The losses also in the use of sound timber for skid poles, corduroys, bridge timber, etc., was estimated and found to be considerable. Rules are suggested for the prevention of waste in logging yellow pine.

Notes on the Benguet pine, W. M. MAULE (*Forestry and Irrig., 12 (1906), No. 8, pp. 355–359, figs. 5*).—A description of the Benguet pine (*Pinus insularis*) is given, with an account of its occurrence, growth, and character. It is one of the two principal species of pines native to the Philippines. A table is given showing the diameter growth of trees from 37 to 145 years old. This varies from 15 to 34 inches.

Ornamental and shade trees, P. B. KENNEDY (*Nevada Sta. Bul. 61, pp. 61, figs. 27*).—Popular directions are given for the culture of shade trees in Nevada, with brief descriptions of a large number of trees and shrubs.

Prolonging the life of telephone poles, H. GRINNELL (*U. S. Dept. Agr. Yearbook 1905, pp. 455–464, pl. 1, figs. 4*).—The author estimates that there is in operation at the present time in the United States 800,000 miles of pole lines and that the average length of life of untreated poles is 12 years. For the maintenance of the present lines over 2,650,000 poles are required annually. The length of life of poles may be considerably increased by treating with preservatives.

An account is given of a number of experiments under way by the Forest Service to determine the best methods of treatment, cost, and the increased length of life due to the treatment. The cost of a green pole at the setting hole is estimated at $5. If preservatives are applied to the outside of the pole between 2 feet and 8 feet from the butt the cost is placed at $5.40 and the increased length of service of the pole 4 years. If the butts are soaked in tanks for a distance of 8 feet the cost at the setting hole is placed at $5.65 and the increased length of service over untreated poles is about 8 years. In other words, the annual cost for a green pole is 53.28 cents, of a pole treated by the first method noted above 46.34 cents, and by the second method 41.57 cents.

An attempt was made to force preservatives into the butts of poles, but owing to the presence of seasoning checks the penetration was not uniform and this method was discarded.

Memorandum on mechanical tests of some Indian timbers, W. H. EVERETT (*Calcutta: Govt., 1906, pp. 7*).—Tabulated data are given showing the results of mechanical tests of about 100 pieces of wood, representing many different species of trees. The data cover shearing strength, crushing strength, bending strength, and stiffness.

DISEASES OF PLANTS.

Report on plant diseases prevalent in Nebraska during the season of 1905, F. D. HEALD (*Nebraska Sta. Rpt. 1905, pp. 19–81*).—Notes are given on the occurrence of a large number of plant diseases observed in Nebraska during the period covered by this report, the data being arranged under different groups according to the host plants. In addition suggestions are given for the prevention of these diseases, so far as means are known.

Infection experiments with Erysiphe graminis, G. M. REED (*Reprinted from Trans. Wis. Acad. Sci., Arts, and Letters, 15 (1905), pt. 1, pp. 135–162*).—The author reviews the investigations of a number of experimenters on the specialization of mildews, the investigations seeming to indicate that "although there are definite physiological species, normally restricted to one or a few host plants, yet injured host plants of one physiological species may be infected by spores of another physiological species and, in this way, the mildew may be bridged over from one host plant to another."

The author reports a considerable number of infection experiments, using the conidia of *E. graminis* from blue grass and rye. For the most part he has sought to infest grasses that are in common cultivation and which are consequently often exposed to infection from both rye and blue grass. To test the results reported by Marchal (E. S. R., 14, p. 666) spores from rye were sown on wheat, oats, barley, wild barley, soft brome grass, and a number of species of Poa. With one exception, none of the seedlings or leaves inoculated became infected, although the experiments were continued from 8 to 15 days. A further experiment showed that the spores from rye would not infect other cereals. The experiments with mildew from blue grass showed that this mildew would not readily infect the other species of Poa experimented with.

In conclusion the author states that his experiments indicate that spores of the mildew from one grass will not infect a grass belonging to a different genus. It is quite possible that for *E. graminis* there is one, if not more, distinct physiological species for each genus of grasses that contains species which are hosts for this mildew. In many genera of grasses the specialization has undoubtedly gone still further, so that there may be a number of physiological forms upon the various species of the same genus. This is indicated by the author's work with various Poas and leads him to the conclusion that there is more than one at least partially differentiated physiological form for this genus alone.

A brief bibliography concludes the publication.

A preliminary report on the blast of rice, H. METCALF (*South Carolina Sta. Bul. 121, pp. 43*).—This bulletin is the result of studies and investigations on rice diseases carried on in cooperation between the South Carolina Experiment Station and the Bureau of Plant Industry of this Department. The present bulletin is preliminary, and further investigations are to be carried on with fertilizers and other methods of soil treatment, as well as experiments to determine the exact nature of rice blast.

Rice blast is known to be present in practically all of the regions devoted to rice culture in South Carolina and it has also been reported from Louisiana and Texas. In addition to lowland rice it is known to affect upland rice wherever grown in South Carolina, and while in general the disease resembles that called brusone in Italy, it does not appear to be identical with it.

The characteristic features of rice blast are distinct lesions at one or more joints. Beginning as small spots on the sheath nodes the tissues underneath gradually die until the joint is partially or entirely involved. In consequence the parts of the plant above the affected joint die by degrees. This cutting off may take place at any joint above the water and at any stage from the shooting

of the head until the grain is mature. According to weather conditions and the length of time that the dead top of the stalk is subject to the action of weather, it may appear bleached, blackened, or discolored in various ways. Very frequently the stalk breaks off at the point of attack, and in 70 per cent of all cases observed the point of infection was at the lowest joint on the rachis, or what is popularly known as the neck. If the lesion is below the neck, the first sign of the disease is one or more minute spots, which appear on the sheath node directly above the joint. At first the tissues appear water-soaked and sunken and later the spots become discolored, brownish, or black. This discoloration spreads up the sheath, but usually for not more than an inch, and downward for a distance of one-fourth to one-half inch. The spot becomes more shrunken and extends laterally, girdling the stem. The skin becomes broken, resulting in an open wound, which may appear blackened from the growth of various organisms on the dead tissues. A microscopical examination of the neck shortly after the appearance of the spot reveals the presence of the spores of a fungus, but as yet it has not been positively identified. Thus far experiments have not determined the exact cause of the disease.

The rice blast does its damage by arresting the development of grain, which may be done at any time. The financial losses due to this cause are very great, and in some localities the disease has resulted in the abandonment of rice cultivation.

Investigations conducted to determine whether the disease might be distributed by other plants than rice seem to indicate that while it may affect a few species of plants, such as *Panicum crus-galli*, yet it is improbable that the disease can originate or spread from this source.

A number of typical cases of blast, as observed in plantations, are described, after which the author discusses the conditions of spread and methods of control. So far, there does not appear to be any connection between the disease and weather conditions, nor is there any evidence that the blast is transmitted by seed. There does appear, however, to be a distinct relationship between the soil conditions and the disease. It has been shown that the blast may be readily produced by inoculating healthy plants directly from diseased ones, but so far it has not been produced by pure cultures of any one organism. The disease occurs in its most virulent form on rested land, land that has been recently reclaimed, or land that is fertilized with nitrogenous fertilizers.

In considering methods of control, the author discusses water treatment, the use of fertilizers, spraying, securing immune plants, etc. The best results have been obtained where marl or lime were used as fertilizers. It is believed that the disease has practically run its course in South Carolina and will not spread further unless nitrogenous fertilizers are used or resting is practiced on these lands that are annually producing poorer and poorer crops. Such lands should be treated with great care and should not be rested under any circumstances, nor should nitrogenous fertilizers be applied to them.

So far as known, there are no varieties of rice that are entirely immune to this disease, and variety tests and selections for immunity have thus far failed.

Brief notes are given on other diseases of rice, among them smut, rust, damping off, spotted blight, etc., most of these diseases being fairly well known and capable of control.

A brief list of works relating to rice diseases completes the bulletin.

Diseases of sweet potatoes in Alabama, E. M. Wilcox (*Alabama College Sta. Bul. 135, pp. 16, figs. 4*).—A preliminary report is given on some of the diseases to which the sweet potato is subject in Alabama, the principal ones described being black rot, dry rot, scurf, soft rot, soil rot, stem rot, and white rot. Where preventive treatments are known the author has described them.

A bibliography of the more important literature relating to the diseases of the sweet potato completes the bulletin.

A new bacterial disease of the pods of some leguminous plants, E. VON OVEN (*Centbl. Bakt.* [etc.], *2. Abt., 16 (1906), No. 1–3, pp. 67–74, pl. 1*).—A description is given of a bacterial disease of peas and other leguminous plants that was investigated by the author in 1905. The disease was first noticed in the vicinity of Berlin and proved very destructive. Its cause is said to be *Bacillus leguminiperdus* n. sp., which attacks the fruiting pods of peas, beans, wax beans, lupines, etc., and possibly will be able to destroy the fruits of other plants, particularly those of tomatoes. The diseased pods appear to be smaller and ripen earlier, the ripened fruits being darker and quite unlike the normal ones. The organism was isolated and cultivated in pure cultures, and inoculation experiments showed the possibility of transfering it to all available legumes, tomatoes, etc. The organism is said to be very unlike that of *Bacillus phaseoli*, previously recognized as causing disease of beans, etc. (E. S. R., 9, p. 1058.)

Apple scab in eastern Washington, W. H. LAWRENCE (*Washington Sta. Bul. 75, pp. 14*).—In a previous publication (E. S. R., 16, p. 573) the author gave the results of a study of the life history of the fungus causing apple scab in western Washington, and also some experimental work in combating it. In the present bulletin an account is given of additional work recently carried on in the eastern part of the State, where the climatic conditions are quite different from those reported in the previous publication.

The general development of the fungus in the eastern part of the State was noted, but no additional facts were found regarding its life history. The rapid increase in the amount of disease is shown in a table, giving the percentage of the disease on 12 varieties during the past season, which shows an average increase of 52 per cent in scabby fruit.

Experiments were carried on for the prevention of the disease in which trees were sprayed with ordinary Bordeaux mixture and also dust Bordeaux. On 85 trees representing 15 varieties sprayed with dust Bordeaux, the average percentage of clean fruit was 13 per cent, while on 50 trees representing the same number of varieties that were not sprayed the average percentage of clean fruit was 6 per cent. On the other hand, 60 trees representing 8 varieties that were sprayed with liquid Bordeaux gave an average of 89 per cent clean fruit, showing the evident superiority of the liquid Bordeaux for the prevention of this disease.

Notes are given on the preparation and application of the fungicides.

The black rot of apples due to Sclerotinia fructigena, F. D. HEALD (*Nebraska Sta. Rpt. 1905, pp. 82–91, pls. 2*).—Attention is called to the fact that the rotting of fruits by *Sclerotinia fructigena* has generally been characterized as the brown rot, and that some symptoms attending this rot have hitherto escaped American and English investigators.

The form here described is that known as black rot, which has been noted by several German investigators, and is attributed to attacks of Monilia. As the black rot due to Monilia and that caused by *Sphæropsis malorum* have been confused, attention is called to some of the external differences. In apples affected by the Monilia the skin is shiny, coal black, smooth, and perfectly free from external evidence of fungus mycelium or fruiting bodies, while in the case of fruits attacked by Sphæropsis the surface of the apple is sometimes brown and soon becomes dotted with black pustules containing the pycnidia of the fungus. The areas between the pustules are darkened, giving the whole surface a dark brown or black color. In Monilia-affected apples the fruit does not shrivel

greatly, while, on the contrary, those affected with Sphæropsis become greatly reduced in size and exhibit an irregular wrinkled surface. Experiments with cultures and inoculations show the difference in the two diseases.

The author believes that a lack of moisture is one of the important factors in determining the development of the Monilia. The precautions taken to prevent the occurrence of scab and other fungus diseases by spraying with Bordeaux mixture, removing mummy fruits, etc., are recommended for the prevention of this disease.

A brief bibliography completes the account.

Pear blight (*Oklahoma Sta. Rpt. 1906, p. 43*).—A summary is given of a press bulletin previously issued by the station calling attention to pear blight and giving suggestions for its control. The varying susceptibility of different varieties to blight is pointed out and the desirability of additional data in respect to liability to disease is indcated.

The ripe rot or mummy disease of guavas, J. L. SHELDON (*West Virginia Sta. Bul. 104, pp. 299–315, pls. 4, fig. 1*).—The author reports having observed in the greenhouses of this Department some diseased guavas, from which material was collected for study on account of the similarity of the disease to the bitter rot of apples. Supplemental material was obtained from Porto Rico and Florida, and a study made of the fungus and its effect upon the fruit.

The disease, which has been previously described as due to *Glœosporium psidii* (E. S. R., 16, p. 477), seems to be rather widely distributed, and the fungus is known to occur in Porto Rico, Florida, California, Mexico, and Australia.

When infested by the fungus brown spots appear on the ripening fruits, and these spots gradually increase until the entire fruit becomes affected, the decayed fruits finally falling off or remaining on the trees as mummies.

A study of the fungus to determine its relationship with allied species led the author to believe that it should be associated with the genus Glomerella.

The presence of copper in olive oil obtained from fruit sprayed with Bordeaux mixture, N. PASSERINI (*Atti R. Accad. Econ. Agr. Georg. Firenze, 5. ser., 3 (1906), No. 1, pp. 139–144*).—In the author's investigations olive oil was found to contain traces of copper whether the trees had been sprayed or not. The amount found in oil from olives grown on sprayed trees was not appreciably greater than from olives grown on unsprayed trees. The quantity present, which was less than 1 mg. per kilogram of oil, was so small as not to be injurious when eaten. The quantities found ranged from traces to 0.49 mg. per kilogram in oil from olives on untreated trees and from a mere trace to 0.47 mg. on treated ones.

Combined treatment for powdery and downy mildew, L. HUGOUNENQ (*Rev. Vit., 25 (1906), No. 644–646, pp. 429–433*).—In commenting upon the efficiency of the treatment suggested for these diseases (E. S. R., 17 p. 876), in which the addition of an alkaline polysulphid to a neutral copper acetate solution was recommended, the author states that this fungicide proved very adhesive and quite efficient in combating both diseases.

The addition of the polysulphid to the copper solution is said to result in the formation of a chocolate-colored precipitate mixed with a small quantity of sulphur. When sprayed upon foliage this copper polysulphid becomes copper sulphid through exposure to the air and later is further changed into copper sulphate and sulphur.

Experiments in combating downy mildew of grapes, N. PASSERINI (*Atti R. Accad. Econ. Agr. Georg. Firenze, 5. ser., 3 (1906), No. 1, pp. 145–148*).—Experiments are reported which were carried on in 1905 relative to the efficiency of copper sulphate neutralized with lime; copper sulphate and iron sul-

phate neutralized with lime; copper sulphate, alum, and lime; and iron sulphate neutralized with lime, these fungicides being tested for the control of downy mildew of grapes.

Groups of vines in the vineyard were sprayed under similar conditions, 4 applications being given them, and the effect of the treatment was determined by a committee of inspection. The amounts of copper per unit of leaf surface after the different sprayings up to the beginning of October are reported.

In every case more copper was present where the vines had been sprayed with a 0.5 per cent solution of copper sulphate neutralized with lime than on any of the other lots. Iron sulphate was found to be without appreciable effect in checking the downy mildew. The addition of iron sulphate to the copper solution diminished the efficiency of the Bordeaux mixture, and the solution to which alum was added was not as valuable as that in which copper sulphate and lime alone were used.

American gooseberry mildew (*Dept. Agr. and Tech. Instr. Ireland Jour., 6 (1906), No. 3, pp. 445–447, pl. 1, figs. 2*).—An account is given of the gooseberry mildew (*Sphærotheca mors-uvæ*), which is reported as occurring on red currants in Kilkenny County, Ireland, and a warning is given regarding its possible spread. For its prevention the author recommends spraying with a solution of 2 oz. of potassium sulphid in 3 gal. of water.

A disease of cottonwood due to Elfvingia megaloma, F. D. HEALD (*Nebraska Sta. Rpt. 1905, pp. 92–100, pls. 4*).—The author reports having observed specimens of living cottonwood in which the entire heart and sapwood were permeated by the mycelium of the fungus *Elfvingia megaloma*, which produced a gradual dissolution or decomposition of the wood cells and rendered the wood soft and punky in some instances and very brittle in others.

A brief historical statement is given regarding the distribution of this fungus, the symptoms produced, the anatomy of the host plant, etc., and suggestions are given for its control, which consist in the removal of the diseased trees, destruction of the sporophores, etc.

Peridermium cerebrum and Cronartium quercuum, C. L. SHEAR (*Jour. Mycol., 12 (1906), No. 83, pp. 89–92*).—The common occurrence of *Peridermium cerebrum* on trunks of ordinary pine about Washington and also the abundance of *Cronartium quercuum* on oaks in the same vicinity led the author to an investigation to determine the possible connection between the two forms.

A number of inoculation experiments were undertaken, and the large number of sori occurring on most of the artificially inoculated leaves as compared with the very small number found on the surrounding ones, taken in connection with their much earlier appearance, seems to indicate a genetic relation between the two forms. While the matter can not be regarded as settled, the evidence at hand seems to indicate the connection between the species of Peridermium and the uredo and teleutospore stages which are found on various species of oaks.

A list of species of pine and oak upon which the two forms are found is appended.

The adherence of copper fungicides, G. GASTINE (*Bul. Mens. Off. Renseig. Agr. [Paris], 5 (1906), No. 5, pp. 595–603*).—After giving a summary of the investigations of Girard (E. S. R., 3, p. 734) and Guillon and Gouirand (E. S. R., 10, p. 651), the author describes his investigations relative to the adhesiveness of various copper fungicides.

The coefficients of adhesiveness were determined in a manner somewhat different from that usually employed. The fungicide was thoroughly distributed over grape leaves and glass plates, and after drying, the leaves and plates were washed and the amount of copper removed determined. The proportion between

the amount remaining and the original amount is given as the coefficient of adhesion.

The fungicides tested were Bordeaux mixture, soda Bordeaux, copper acetate solutions, ammoniacal copper carbonate solution, and several special trade preparations. All the fungicides were so prepared as to contain approximately the same amounts of copper.

In the summary of the author's conclusions it is shown that the alkaline Bordeaux mixture made by what is termed the American method and the same mixture to which molasses or linseed oil was added were the most adhesive, from 90 to 95 per cent of the copper remaining on the leaves. Neutral Bordeaux mixture had a coefficient of 75 to 80 per cent, and acid Bordeaux mixture 50 to 55 per cent. The adhesiveness is said to be diminished by mixing the copper sulphate and lime in too concentrated forms. Delay in application after preparation reduces adhesiveness, although the molasses Bordeaux mixture retains its coefficient of adhesiveness after standing for 48 hours. Neutral soda Bordeaux mixture had a coefficient of 85 per cent when made by the American method. Where this mixture was alkaline 72 to 75 per cent remained on the leaves. When freshly prepared from dry powdered chemicals it had a coefficient of 70 to 75 per cent, but if the powders were allowed to stand for several hours the adhesiveness fell to 50 per cent or less. This was also found true for a number of proprietary mixtures which are sold in powdered form. All the mixtures containing carbonate of soda lost their adhesiveness rapidly, and after standing during 2 days of warm weather prior to application to the foliage all traces of copper were removed by the washing process. Mixtures to which soap or sugar was added differed but little from ordinary soda Bordeaux mixture in their adherence.

In general the copper acetate solutions were less adherent than those described above. Neutral copper acetate had a coefficient of 50 to 52 per cent, but by the addition of sulphate of soda it was increased to 58 to 65 per cent. By the addition of kaolin to neutral copper acetate the coefficient of adhesiveness was increased to 65 to 72 per cent, and where ammonia was added it was increased to 80 to 83 per cent. The copper acetate and ammoniacal solutions did not seem to depreciate very much on standing. Eau celeste had a coefficient of 56 to 58 per cent, ammoniacal copper carbonate solution 73 to 76 per cent, and copper formate 82 to 83 per cent.

In practice the forms of Bordeaux mixture give the best results, but they offer many difficulties of preparation and application that the copper acetate solutions do not. On this account the author believes that solutions will probably be found adapted to general use, although their adherence to the foliage is not as perfect as those fungicides containing lime.

The use of dilute solutions of sulphuric acid as a fungicide, H. KRAEMER (*Science, n. ser., 23 (1906), No. 599, p. 941*).—In a paper presented at the celebration of the two-hundredth anniversary of the birth of Benjamin Franklin, the author gives the results of the use of dilute solutions of sulphuric acid as a fungicide for preventing the mildew on roses.

The fungicide was tested on plants growing outdoors as well as in the greenhouse, and the application of a solution containing approximately 1 part of sulphuric acid to 1,000 parts of water was employed. The roses were uninjured by the acid solution, and they began immediately to develop new leaves and young shoots entirely free from mildew after from 3 to 6 applications on alternate days. Should subsequent experiments confirm these observations, the use of sulphuric acid will have certain advantages over the use of sulphur, as it does not discolor the foliage and its employment is more easily controlled.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Federal game protection. A five years' retrospect, T. S. PALMER (*U. S. Dept. Agr. Yearbook 1905, pp. 541–562, pl. 1, figs. 13*).—A summary is presented of the main features in the work of game protection in the past five years. The chief points considered are the Lacey Act, importation of foreign birds and mammals, interstate commerce in game, cooperation of this department with State officials and Audubon societies, and the game preserves.

Directory of officials and organizations concerned with the protection of birds and game, 1906, T. S. PALMER (*U. S. Dept. Agr., Bur. Biol. Survey Circ. 53, pp. 16*).—The purpose of the present directory is to furnish the names of persons in the different States and Territories from whom information may be had respecting the local game laws and the requirements which must be met by individuals who wish to hunt in different localities.

The zoological record, D. SHARP (*Zool. Rec., 41 (1904), pp. LXV + 1202*).—In this volume detailed bibliographical lists are given of literature relating to the various groups of the animal kingdom and published for the most part during the year 1904.

Meadow mice in relation to agriculture and horticulture, D. E. LANTZ (*U. S. Dept. Agr. Yearbook 1905, pp. 363–376, pls. 4, figs. 1*).—Of the 165 species of Microtus known to science about 78 are found in North America. Some species of meadow mice show a very large distribution and often occur in such numbers as to be a serious menace to fruit raising and gardening.

The feeding habits of meadow mice are described and notes are given on their natural enemies, which include a number of birds and mammals. The unusual prevalence of meadow mice in certain localities is attributed to the destruction of their natural enemies.

Considerable success in the control of meadow mice has been had with the use of grain or some other form of bait poisoned with strychnine, the drainage of swamps, a periodic plowing of grass lands which serve as breeding grounds for meadow mice, and the destruction of weeds and dead grass in the fall by burning or other methods.

Requirements to be complied with by nurserymen or others who make interstate shipments of nursery stock, A. F. BURGESS (*U. S. Dept. Agr., Bur. Ent. Circ. 75, pp. 6*).—This circular contains in a condensed form the essential requirements of the laws of various States regarding the shipment and introduction of nursery stock. A more complete account of these laws will soon be published by the Bureau of Entomology.

Report of the entomologist, D. L. VAN DINE (*U. S. Dept. Agr., Office Expt. Stas. Bul. 170, pp. 38–59, pl. 1*).—A brief account is presented of the organization of entomological work in Hawaii and of the working staff and equipment.

Bee keeping is fostered to a considerable extent, and the author presents a list of native and introduced bee plants. Likewise with silk production much energy is being expended in encouraging this industry, and it appears to be well suited to the conditions of the Hawaiian Islands. Quite favorable results were obtained from a test of cold storage in the shipment and preservation of silkworm eggs. A committee of citizens has been appointed to make a study of the situation with regard to mosquitoes and considerable work has been done in the study of fish which eat mosquitoes.

A partial list is presented of the insects injurious to various cultivated crops in Hawaii and a bibliography is given of publications relating to Hawaiian entomology.

Report of the entomologists, C. H. and H. T. FERNALD (*Massachusetts Sta. Rpt. 1905, pp. 149–152*).—During 1905 a number of injurious insects were ob-

served in unusual abundance. Particular attention was given to the study of the San José scale, cutworms, army worms, and various other pests, as well as to fumigation of greenhouses. The authors state that the gipsy moth is now spreading rapidly over the State.

Fifth report of the State entomologist and plant pathologist of Virginia, J. L. Phillips (*Rpt. Va. State Ent. and Plant Path., 5 (1904–5), pp. 88, figs. 14*).—In this report an account is given of the work in controlling the San José scale in Virginia in the years 1903–1905. The organization and scope of the work is described with notes on nursery and orchard inspection. In growing nursery stock free from San José scale it is recommended that a site be selected as little infested as possible with no orchards near the intended nursery. All stock should then be fumigated and after the first winter should be treated twice annually with lime and sulphur wash.

An account is presented of the present status of nursery and orchard inspection in Virginia, with a description of fumigation methods and their effectiveness as applied under different conditions for the destructon of San José scale, scurfy scale, and other pests. The action of hydrocyanic acid on nursery stock was also studied, with the result that this appeared not to be a serious matter under ordinary conditions. The only common causes of unsatisfactory results in fumigating nursery stock are the use of adulterated potassium cyanid and the practice of fumigation during midwinter when the scale insects are least susceptible to fumigation.

Detailed directions are given on the preparation and effectiveness of lime-sulphur wash made according to different formulas and various other insecticide preparations.

Report of the entomological division, W. R. Dewar (*Orange River Colony Dept. Agr., Ann. Rpt., 1 (1904–5), pp. 183–238, figs. 8*).—The organization and work of the division of entomology are briefly outlined with notes on the routine work.

Particular attention is being given at present to the control of locusts by means of arsenical solutions and by other methods, as well as to the distribution of ladybirds, control of noxious weeds, and study of various miscellaneous insects, including ticks, *Bagrada hilaris*, cabbage aphis, diamond-back moth, potato moth, bean weevils, boll weevil, grain aphis, red scale, and other scale insects.

A brief report is made by C. N. Johnston on the birds of Orange River Colony in their relation to agriculture.

Farm practice in the control of field-crop insects, F. M. Webster (*U. S. Dept. Agr. Yearbook 1905, pp. 465–476, pls. 2, figs. 2*).—In order to control the insects which attack field crops it is necessary that the farmer should have a practical knowledge of the habits of these pests. The best results are obtained by the use of a suitable system of crop rotation combined with thorough plowing at seasons when the insects would be most injured by such operations, good tillage, occasional summer fallowing, and the destruction of weeds and all unnecessary vegetation in which insects may breed.

Proliferation as a factor in the natural control of the Mexican cotton boll weevil, W. E. Hinds (*U. S. Dept. Agr., Bur. Ent. Bul. 59, pp. 45, pls. 6*).—In the study of the cotton boll weevil by the Bureau of Entomology, attention is given to all details which may in any way bear upon the control of this pest. In 1902 it was noted that the cotton plant has a tendency to protect itself by proliferation of cells at the point of injury by the cotton boll weevil in the squares or bolls. A thorough study of this phenomenon has been carried on to date and statistics collected bearing on the problem of the effectiveness of this tendency of the plant in controlling the pest.

It appears from these observations that in many varieties of American upland cotton proliferation takes place in 51 per cent of the cases of weevil attack upon squares and in 55 per cent of those upon bolls. The increased rate of mortality among weevils as a result of this proliferation was found to be 13.5 per cent in squares and 6.3 per cent in bolls. Climatic conditions appear to have little effect upon proliferation, and all varieties of American upland cotton appear to proliferate to about the same extent. The use of fertilizers apparently does not increase proliferation and the proliferating tissue is not poisonous to the weevils. Death results from mechanical causes.

Destroying weevils in cowpeas (*Oklahoma Sta. Rpt. 1906, pp. 33–35*).—Brief data are given relative to the amount of damage caused by weevils in cowpeas. Experiments with gasoline and carbon bisulphid showed that the gasoline did not evaporate as readily as carbon bisulphid and is less effective than the latter. One pound of carbon bisulphid was found to be sufficient to treat 40 bu. of cowpeas.

A locust campaign, E. R. SAWER (*Rhodesian Agr. Jour., 3 (1906), No. 3, pp. 225–230*).—Attention is called to the great devastation which may be worked by the locust if these pests are not controlled. The organization of the field work in the locust campaign in South Africa is described. Particular attention is given in this campaign to *Pachytylus sulcicollis* and *Acridium purpuriferum*. The methods of destruction are quite varied, but the most effective and most economic appears to be in the use of an arsenical spray.

Locust birds and locust poisons, C. P. LOUNSBURY (*Agr. Jour. Cape Good Hope, 28 (1906), No. 3, pp. 364–366*).—Several complaints were made that the extensive use of arsenic and other poisons in the destruction of locusts had led incidentally to the poisoning of locust birds from eating the dead locusts. The opinions of a number of entomologists who had experience with this matter in South Africa are quoted to the effect that no such poisoning takes place. It appears that birds or domestic fowls may eat poisoned locusts in considerable quantities without thereby being badly affected.

Codling moth work in 1904, E. D. BALL and E. G. PETERSON (*Utah Sta. Bul. 95, pp. 65–107, figs. 12*).—The authors in their work on the codling moth have proceeded on the basis that the first work to be done is a careful determination of the life history of this pest under local conditions. Various points connected with the habits and life history of the codling moth in Utah were carefully worked out anew so that the practical spraying experiments devised by the authors rested on a scientific basis.

The work reported in the present bulletin had for its chief objects the determination of the relative value of early and late sprays and the separation of the injury caused by the first brood from that of the second. The spraying experiments were carried out in 3 orchards containing a number of varieties. Paris green was applied at the rate of 1 lb. to 120 gal. of water. The early applications were made just after the blossoms fell (May 28 to June 1) and a second time (June 10 to 14). Three late applications were made on August 4, August 18, and September 2. All of the trees were banded and the bands examined every 3 days in order to count the larvæ. All windfalls were carefully examined, and between August 1 and 3 all of the apples on the trees were examined to determine whether the larvæ entered through the calyx or side of the apple.

The observations on the periods covered by the 2 broods of codling moth in Utah indicate clearly that August 1 is about the separating point between the 2 broods. The results of spraying were carefully determined with reference to the production of the first and second broods of codling moth. It appears that two early applications of Paris green killed 89 per cent of the first brood of

codling moth the first year, and 96 per cent where the method was continued for 2 years. It is also learned that two-thirds of the worms entered the apple through the calyx. The two early applications destroyed all but 4 per cent of the worms which attempted to enter through the calyx, while 22 per cent of those which attempted to enter the side of the apple escaped the Paris green.

From observations made in Colorado and elsewhere the authors believe that the second brood is about 5 times as numerous as the first. The average number of wormy apples per tree without spraying was 247 as a result of the attack of the first brood. If the second brood is 5 times as numerous this would make an average of 1,482 wormy apples per tree during the season if unsprayed, while the average number on sprayed trees would be 162 the first year and 66 the following year if the treatment is repeated. The authors also determined that 90 per cent of the worms which entered the calyx during August and September were killed by Paris green which had been applied in June. This indicates the lasting effect of the early applications. The total cost of two arsenical applications, banding and examining the bands during the season, was 14 to 21 cts. per tree or 1½ to 2 cts. per bushel of apples.

As a result of their work on the codling moth the authors conclude that the only proper time for the early spray is just after the blossoms fall and before the calyx closes. It appears that the two early applications of Paris green will kill nearly nine-tenths of the codlinng moth up to August 1 and that enough poison remains to kill two-thirds of the larvæ of the second brood. The three late applications destroyed three-fourths of the second brood of codling moth, but the early sprays appear to be of much more value than late ones, since late sprayings alone will not save the crop in badly infested orchards.

The codling moth in the Yakima Valley, A. L. Melander and E. L. Jenne (*Washington Sta. Bul. 77, pp. 96, pls. 13, figs. 7*).—The codling moth has been known in the State of Washington for 25 years and in the warmer river valleys causes an almost total destruction of the apple crop if no protective measures are taken.

An elaborate test of insectides was made in a number of orchards, using a gasoline power sprayer in some cases. The habits and life history of the codling moth are described in detail, with especial reference to the bearing of available data upon the number of broods of this pest. In the Yakima Valley there appeared to be 2, and possibly 3, broods of the codling moth, the first and second broods being separated by a period of 3 or 4 weeks.

The authors found that the windfalls rarely contain larvæ of the codling moth. About 70 per cent of the first brood of larvæ attempt to enter the apples at the calyx end within 2 to 5 weeks after the blossoms have fallen. The second brood begins to enter the apples toward the end of July. According to the authors about 60 per cent of the larvæ drop to the ground after leaving the apples, the remaining 40 per cent crawling down the trunk of the tree. It is recommended, therefore, that bands on apple trees should be inspected at intervals not greater than 2 weeks. Rarely pears, peaches, and prunes are infested with the codling moth. Notes are also given on natural enemies of this pest.

In spraying for the codling moth arsenate of lead is recommended as the best remedy. Fruit growers are advised to buy arsenate of lead from reliable dealers rather than attempt to make it themselves. Paris green is also effective when used at the rate of 1 lb. to 125 gal. of water, but London purple and arsenoids are not recommended. If a given neighborhood is not badly infested it will be unnecessary to spray for the second brood; otherwise, light sprayings are required. In such cases two sprayings for the first brood and two or three for the second are recommended. It is believed that spraying every 2 weeks throughout the season is an unnecessarily expensive system. It was found that

trees may be sprayed 4 times with the power sprayer at the cost of 8 cts. per tree, and with the result of saving 90 per cent of the fruits, while 85 per cent of the crop was free from codling moths after two applications.

The gypsy and brown-tail moths and their European parasites, L. O. Howard (*U. S. Dept. Agr. Yearbook 1905, pp. 123–138, pls. 2, figs. 8*).—The history of these two pests in the United States is briefly outlined with notes on the appearance and habits of both insects, the artificial remedies commonly used against them, and American parasites which have been thus far found attacking them. The author has succeeded in interesting a number of European entomologists in the work of collecting and shipping parasitized specimens of these insects to Boston, where it is hoped parasites will be reared to assist in controlling the pests.

A test of different sprays for the San José scale, W. E. Rumsey and F. E. Brooks (*West Virginia Sta. Bul. 107, pp. 347–354*).—A report is made on the results obtained from the use of 4 brands of proprietary insecticides in controlling the San José scale.

The conclusion is reached that preparations of concentrated soluble oil are the most convenient materials to use in destroying scale insects. They are not only effective, but are easily handled and do not injure the spray pumps, harness, horses, nor the face and hands of the workman.

Directions for checking the cottony scale and the report of State nursery inspection, C. Bues (*Wisconsin Sta. Rpt. 1905, pp. 315–329, figs. 5*).—The cottony maple scale is most easily dislodged from the trees in Wisconsin during the month of June. It is found possible to wash them off the trees by means of a forcible spray of water, and for this purpose the fire department allowed the use of some of its apparatus. Good results are also obtained by spraying in summer with kerosene emulsion and with a strong emulsion in early fall. The work of spraying may be made simpler by suitable pruning of the trees.

A brief statement is given on the condition of nurseries in Wisconsin, and on the present status of San José scale, imported willow weevil, apple leaf hopper, strawberry root louse, apple canker, and other insects and fungus diseases.

The peach-tree borer, H. N. Starnes (*Georgia Sta. Bul. 73, pp. 145–190, figs. 12*).—The borer is not the most important enemy of peaches in Georgia, but in the author's opinion stands about fourth among the pests of this tree. The insect is described in its various stages, and notes are given on its life history as shown by numerous observations made in Georgia and elsewhere.

The methods recommended for the control of the peach borer include wrapping the base of the trees with brown paper or newspaper, mounding the trees with earth, removing the larvæ with steel instruments, and the use of caustic substances for destroying the larvæ. In a series of laboratory experiments it was found that many of the borers were prevented from emerging when buried in the soil to the depth of 3 inches or more. This suggests the possible value of deep plowing just before the borers are ready to emerge from the soil.

The principal insect enemies of the peach, A. L. Quaintance (*U. S. Dept. Agr. Yearbook 1905, pp. 325–348, pls. 7, figs. 7*).—About 190 insect enemies of the peach are known to be of more or less importance. Biological and economic notes are given on many of the most serious insects included in this number, the chief among which are plum curculio, peach borer, San José scale, West Indian peach scale, black peach aphis, peach twig-borer, fruit tree bark-beetle, and nematode root-gall.

Some insects injurious to forests. The western pine-destroying bark-beetle, J. L. Webb (*U. S. Dept. Agr., Bur. Ent. Bul. 58, pt. 2, pp. 11–30, pls. 2, figs. 6*).—According to the observations of several members of the Bureau of Entomology, the western pine-destroying bark beetle (*Dendroctonus brevicomis*)

is the most important enemy of the western pine in certain parts of Idaho where the destruction of this tree was investigated.

The presence of the pest is indicated by dead and dying trees and by pitch tubes and small quantities of resin in the crevices of the bark. The insect is found throughout Idaho and from California to Washington and attacks the western yellow pine and sugar pine. It is estimated that from 2 to 5 per cent of pine timber has been destroyed annually by this pest during the past 3 years.

A brief account is given of the observations made by a number of investigators in Idaho, Washington, and elsewhere. The life history and habits of the insect are traced in some detail and brief notes are given on the natural enemies. The pest appears to attack and destroy the best specimens of trees and is capable of devastating pine trees over large areas. The insect passes the winter in the outer bark of trees which were killed during the previous summer. On this account it is recommended that infested trees be located in the fall and cut between October and May, after which the bark should be removed and destroyed.

Insect enemies of forest reproduction, A D. HOPKINS (*U. S. Dept. Agr. Yearbook 1905, pp. 249–256, figs. 9*).—Insect injuries to forest trees may occur during the period of flowering, fruiting, germinating, or growth of the seedling, sapling, and mature trees. Brief accounts are presented of some of the more noted forest insects and of their attacks upon sprout forests. While ordinary insecticide methods are of some value in the control of forest insects, the chief reliance must be placed on systems of forestry.

Two insect pests of the elm, A. L. MELANDER (*Washington Sta. Bul. 74, pp. 7, fig. 1*).—Elm trees in Washington are sometimes greatly injured by the elm bark-louse. This pest may be controlled by thorough spraying with the lime-sulphur wash during February or March.

The elm leaf-louse is also quite a serious pest, but may be largely controlled by a winter spray of lime and sulphur, or, if this is not given, the use of kerosene emulsion will yield the desired results. Formulas are given for preparing these insecticides.

The mosquito, T. B. SYMONS, T. H. COFFIN, and A. B. GAHAN (*Maryland Sta. Bul. 109, pp. 71–124, figs 37*).—The agency of mosquitoes in transmitting diseases to man is briefly discussed and descriptions are presented of mosquitoes commonly observed in Maryland. Considerable interest has recently been aroused in mosquito extermination, particularly in the neighborhood of Baltimore, where favorable conditions prevail for the multiplication of these pests.

The usual line of treatment is discussed, including drainage and the use of oil and other insecticides. Brief mention is made of some of the less common substances used in destroying mosquito larvæ, including a number of proprietary remedies. The value of lime, copper sulphate, carbolic acid, creosote, and oil is also discust.

Mosquito control, H. J. QUAYLE (*California Sta. Bul. 178, pp. 55, figs. 35*).—At the request of the Burlingame Improvement Club the station undertook an examination of a tract of land near San Francisco badly infested with mosquitoes. The species most numerous in this region was *Ochlerotatus lativittatus*, but the malaria mosquito and other species were also present. A general account is presented of the life history and migration of mosquitoes and of their connection with disease in man.

The campaign of eradication undertaken by the station consisted in the establishment of a thorough system of drainage in the salt marshes where the mosquitoes chiefly prevailed and in the use of oil on a few of the pools in fresh-water creeks. In a few instances similar work was carried out by private individuals to rid their own property of mosquitoes. The success of the

general work of eradication was very striking since during the second season the chief species of mosquito concerned was seen only in the rarest instances.

Some attention was given to the natural enemies of mosquitoes. Under the conditions which prevailed in the region in question fish could not be used advantageously, since they would not voluntarily live in the pools where the mosquitoes bred. The best species for use is apparently the stickleback. A number of insects are also mentioned as enemies of mosquitoes. Copper sulphate was used at the rate of 1 part to 1,000 in small pools, but almost without effect. The author also discourages the hope that eucalyptus will prove of any great value in the work of combating mosquitoes.

The species chiefly concerned in the mosquito campaign in question are described in all their stages and a synoptic table is presented to assist in their determination. A list is also given of the mosquitoes known to occur in California.

A preliminary report on the horseflies of Louisiana, with a discussion of remedies and natural enemies, J. S. Hine (*Crop Pest Com. La. Circ. 6, pp. 43, figs. 20*).—An investigation was made of the distribution of species of horseflies and their injurious attacks in Louisiana and other parts of the South.

The larvæ usually pass their life in the water or under ground and are, therefore, seldom observed. The species of Chrysops and many of those of Tabanus lay their eggs on plants over water, while others deposit on plants standing in wet ground. The larvæ feed on animal life of various kinds. Detailed notes are given on the life history of *Chrysops vittatus* and *Tabanus atratus*. The eggs of the latter species may be carried for many miles in water and the insect may be thus distributed far from the point of its original location.

A number of natural enemies are known to attack the horseflies, some of these insects being predaceous and others parasitic. The use of nets, oil, and insecticides of disagreeable odor may give considerable relief. Covering pools of water with kerosene, as recommended by Porchinski, is not always effective. The author recommends collecting the eggs of horseflies in localities where they are most numerous.

An annotated list is presented of all the species found in Louisiana.

Some points on the natural history of Tabanidæ, especially Tabanus quatuornotatus, A. Lécaillon (*Compt. Rend. Soc. Biol. [Paris], 60 (1906), No. 9, pp. 459, 460*).—The eggs of this species are laid during a period of 2 or 3 weeks in June. The females deposit their eggs during the middle of sunshiny days on dry herbage in masses of about 300 to 400. The egg masses are almost always found about 30 to 50 cm. from the ground. The larvæ, as soon as hatched, fall to the ground and penetrate into the soil.

Habits and life histories of some flies of the family Tabanidæ, J. S. Hine (*U. S. Dept. Agr., Bur. Ent. Bul. 12, pt. 2, tech. ser., pp. IV, 19–38, figs. 12*).—A detailed account is presented of the life history and habits of *Tabanus lasiophthalmus, T. sulcifrons, T. stygius, T. vivax, T. atratus,* and *Chrysops mœrens*. Considerable new information is given, particularly with reference to the place and method of depositing eggs. In some cases this information will be of advantage in devising practical means for controlling horseflies, but these insecticide methods have not been worked out.

British ticks, E. G. Wheler (*Jour. Agr. Sci., 1 (1906), No. 4, pp. 400–429, pls. 6*).—The ticks of Great Britain have received but little study from a systematic standpoint, and on this account the author undertook an investigation of their life history and habits, as well as a study of their form and relationship to diseases in man and animals.

The larger part of the article is occupied with a description and classification of the ticks known to the author as occurring in Great Britain. In this

systematic arrangement the ticks are divided into 2 subfamilies, Argasinæ, and Ixodinæ. A considerable number of species are referred to these families as occurring in Great Britain. These include *Argas reflexus*, *Ornithodorus megnini*, *Ixodes hexagonus*, *I. ricinus*, and species of Hyalomma, Haemaphysalis, Dermacentor, and other genera.

How to get rid of cattle ticks. A. D. Melvin (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 97, pp. 4, fig 1*).—Attention is called to the importance of active cooperation between local officials in various States south of the Texas fever quarantine line and the Bureau of Animal Industry for the purpose of eradicating ticks.

The eradication of ticks is believed to be possible if all suggested precautions are taken. Cattle and premises may be freed from ticks by hand picking the cattle and destroying the ticks, after which the cattle may be thoroughly greased. Infested cattle should be examined every other day, attention being given to the inside and back portion of the thighs, where the ticks are liable to be most numerous. For greasing the cattle, crude oil is recommended, or cotton-seed oil, fish oil, or lard. Where a farmer owns but a few head of cattle, the cattle may be picketed on tick-free pasture and occasionally moved, taking care to avoid these localities for 9 months thereafter.

Another method recommended is the rotation system and requires two fields. The cattle are removed from the pasture by September 1 and no animals are allowed on this pasture until March 15 of the following year. Before the cattle are allowed to go back into the original pasture they should be carefully examined for the presence of ticks.

Tests of dips as lice killers. L. L. Lewis (*Oklahoma Sta. Bul. 72, pp. 8*).—The importance of dips in combating parasites on cattle has long been recognized, and a number of these dips were tested by the author in controlling lice and cattle ticks.

In experiments with coal-tar preparations it was found that the dips were more effective when used at temperatures of 70 to 80° F. than when applied cold. Lice were usually found dead within from 3 to 10 hours after cattle and horses were dipped. Hogs may be regularly dipped, like other animals, or a wallowing vat may be provided containing a small quantity of crude oil on the surface of the water. When this is done, the hogs keep themselves free from lice. Most of the coal-tar dips, which were tested, failed to kill the lice eggs, but kerosene emulsion was more effective in this respect.

Farmers who own but a small number of cattle will find it too expensive to construct vats especially for dippping. For these small owners it is desirable that cattle be regularly inspected about every 2 weeks from July to September, and hand treated with crude petroleum or kerosene emulsion, after the large ticks have been picked off.

The effectiveness of pasture rotation in controlling ticks is also mentioned

The economical preparation of the sulphur-lime spray. R. W. Thatcher (*Washington Sta. Bul. 76, pp. 16*).—It is considered that the efficiency of the lime-sulphur wash is demonstrated and that at present experiments may well be directed toward the preparation of this insecticide more cheaply.

A chemical study was made of the reactions which take place in the preparations of the lime-sulphur wash according to various formulas. From this study it appears that lime-sulphur wash contains 2 soluble compounds, viz, pentasulphid and thiosulphate of calcium. The relative amounts of these 2 compounds are about the same in sprays prepared by any of the formulas and are not influenced by the presence or absence of salt. Blue vitriol, on the other hand, combines with the pentasulphid compound rendering it insoluble. Cal-

cium pentasulphid decomposes rapidly under the influence of the atmosphere after being sprayed on trees and acts energetically as an insecticide. While calcium thiosulphate decomposes more slowly, the continued action of the insecticide long after its application is apparently due to this latter compound. The author believes that the cheapest formula for the preparation of lime-sulphur wash is 1–1–4.

Spray for profit (*Oklahoma Sta. Rpt. 1906, pp. 44–54*).—Directions are given for the choice, preparation, and application of insecticides and fungicides for controlling insect pests and fungus diseases of fruits, garden vegetables, cereals, shade trees, ornamental plants, and cotton.

Silk industry (*Mo. Consular and Trade Rpts.* [*U. S.*], *1906, No. 305, pp. 185–190*).—A statistical account is presented regarding the extent of the silk crop in various countries, including Italy, Austria, Syria, Greece, Persia, and the far Orient. Notes are also given on the methods of growing the mulberry and care of silkworms.

FOODS—HUMAN NUTRITION.

Ropiness in flour and bread and its detection and prevention, E. J. WATKINS (*Jour. Soc. Chem. Indus., 25* (*1906*), *No. 8, pp. 350–357, pl. 1*).—Experiments are reported and data summarized regarding the causes of ropiness in bread, the ways in which ropiness is conveyed, and methods of prevention.

The trouble is produced by varieties of *Bacillus mesentericus* introduced into the dough through the flour where it sometimes occurs in large numbers, possibly coming from the bran coats. Breads containing bran and straight grade white flours are most liable to develop ropiness. The bacillus is a prolific spore former, and the spores are capable of resisting high temperatures for long periods. The development of the bacillus, when once present in the dough after bread has been made, depends partly on the reaction of the bread and partly on atmospheric conditions.

The presence of acid is unfavorable to the development of bacillus, but normal bread is only faintly acid in reaction and always insufficiently so to prevent the development and spread of ropiness. The author's experiments led to the conclusion that "the addition of a small quantity of acetic acid to the dough will effectually prevent the appearance of ropiness in the resulting bread during a much longer period than bread is usually kept. The minimum quantity of acid appears to be about 0.3 lb. per sack of flour, whilst a maximum of 0.7 lb. should not be exceeded on account of its softening action upon the gluten. When lactic acid is employed as a preventive, the minimum quantity is greater: below 0.6 lb. per sack its action is somewhat uncertain. The greater softening action of this acid upon gluten must not be lost sight of when considering the quantity to use."

"Low temperature and dryness of the bread store tend to suppress development, but the maximum temperature of 18° C. (65° F.) can not be exceeded without great risk.

"When a batch of bread is found to be ropy, all flour in stock should be at once tested, so as to locate the infected stock, and in the meantime fresh supplies of flour from a different source should be laid in.

"When the infected batch of flour has been discovered, it should be isolated, so that it can be worked up under those conditions which are most unfavorable to the development of the bacillus, i. e., the doughs being made slightly acid and the bread being quickly cooled and kept at low temperature during storage. Such flour might advantageously be kept until the colder months when the prospects of development are at a minimum.

"During the summer months the danger of purchasing ropy flour may be entirely obviated by the application of the bread-tube test to a sample of the flour before buying."

The paper is followed by a discussion.

Alcohol in bread, L. SCHMELCK (*Norsk Landmandsblad, 25 (1906), No. 9, p. 117*).—Thirteen different samples of fresh bread from 10 bakeries were found to contain from 0.35 to 0.70 cc. of alcohol per 100 gm., the average amount being 0.52 cc. After 10 days about one-half of the original alcohol content was found to be present.—F. W. WOLL.

Foods and food products, whisky and other beverages, and drugs and medicines, E. F. LADD ET AL. (*North Dakota Sta. Bul. 69, pp. 50*).—The investigation reported was carried on under the provisions of the State law regulating the sale of foods, beverages, and drugs.

Foods and food products, E. F. Ladd and A. G. Nickles (pp. 3–22).—A large number of samples of jams, preserves, and jellies, canned vegetables, flavoring extracts, dairy products, meat, fish, sausages, confectionery, and other food products were examined. As shown by comparison with earlier work, the authors point out that there has been a marked decrease in the adulteration of food products, short-weight cans, and "sloppy canned goods."

Whisky, E. F. Ladd and R. E. Stallings (pp. 23–26).—Ninety-five whiskies and brandies were examined.

Drug and proprietary products, E. F. Ladd and C. H. Kimberly (pp. 27–50).—A large number of drugs and medicines were examined.

Table sirups, H. W. WILEY (*U. S. Dept. Agr. Yearbook 1905, pp. 241–248, pls. 2*).—The manufacture and food value of sirups made from maple sap, sorghum juice, and cane juice are spoken of and the superiority of natural sirups emphasized.

"The sirup made directly from the sugar cane must of necessity commend itself to the consumer in comparison with the use of molasses arising as a by-product of sugar manufacture. In the production of sugar it is an economic necessity to make a white product, and this requires the use of bleaching agents of some description. Among these sulphur is perhaps the most common. Also, in the washing of white sugar in the centrifugal, solutions of salts of tin or of indigo are often employed for giving an additional luster to the sugar. This bleaching agent must of necessity remain in the molasses, making it to this extent unsuitable for consumption. For these reasons it is evident that the production of a table sirup directly from the original source should be encouraged.

"It appears from a general survey of the data which have been collected in these experiments that it is entirely possible to supply the demand for table sirup in the United States directly from the original sources, thus removing the danger of adulteration or contamination with substances injurious to health. The general consumption of a sirup of this kind would, it is true, interfere with the industry which is engaged at the present time in making a synthetic sirup for table use from doubtful sources, but which as a rule contains more or less molasses—the by-product of sugar manufacture—and contaminated more or less with substances injurious to health. The general welfare of the farmer and consumer would therefore be promoted by the general consumption of pure sirups of the kind which have been described."

Fruit and its uses as food, C. F. LANGWORTHY (*U. S. Dept. Agr. Yearbook 1905, pp. 307–324, fig. 1*).—Among the questions considered in this general summary are color, flavor, and composition of fruits, effect of ripening on composition, the place of fruit in the diet, digestibility, and relative economy, raw and cooked fruit, and the hygiene of fruit.

"In general, it may be said that fruits are wholesome, palatable, and attractive additions to our diet, and may be readily made to furnish a considerable part of the nutrients and energy required in the daily fare. Fresh fruits are dilute foods and closely resemble green vegetables in total nutritive value, but dried fruits and many preserves, etc., are much more concentrated, comparing favorably with some of the cereals and other dry vegetable foods in the amount of total nutrients and energy which they supply per pound. The characteristic chemical constituents of fruits are carbohydrates, and so they are naturally and properly used in a well-balanced diet to supplement foods richer in protein, as cereal grains, legumes, nuts, eggs, dairy products, meats, and fish. Intelligently used, fruits are a valuable part of a well-balanced diet and may well be eaten in even larger quantities that at present."

Practical directions for preserving native fruits and vegetables, Mrs. L. H. ADAMS and E. P. SANDSTEN (*Wisconsin Sta. Bul. 136, pp. 13*).—Household methods for making jams, jellies, preserves, etc., are described, particular attention being paid to the use of native fruits. A few directions for canning vegetables are also given.

The energy required by man in the form of heat, E. MAUREL (*Compt. Rend. Soc. Biol.* [*Paris*], *60* (*1906*), *No. 18, pp. 863–866*).—The author briefly summarizes his own investigations and discusses other published work. His own estimate of the average amount of energy required in temperate regions in spring and fall by a man weighing 65 kg. is 2,400 calories, in summer 2,000 calories, and in winter 2,800 calories.

ANIMAL PRODUCTION.

Condimental and tonic stock foods, W. FREAR (*Pennsylvania Sta. Rpt. 1905, pp. 41–59*).—A number of condimental and tonic stock foods were examined chemically and microscopically and data summarized regarding the effect of such feeding stuffs on the rations of farm animals.

Analysis shows that these feeds are in general made up of cereals and commercial by-products and of ordinary and inexpensive drugs, such as copperas, Epsom salts, fenugreek, gentian, mustard, sulphur. The price at which they are sold is usually out of all proportion to their nutritive value and the cost of their ingredients. The data summarized show that, generally speaking, aromatic foods do not increase the flow of digestive juices nor do such feeding stuffs induce greater gains in weight or milk yield. As the author points out, animals in health rarely need these feeds while those which are sick need special treatment. "The farmer can make his own condimental mixture far more cheaply than he can buy most of the market preparations."

"It will not do, however, to infer that such mixtures are never uesful, even though they do not cause the healthy animal to improve in its functional activities, do not ward off disease, nor promise cure of well-developed disorders. When used in sufficient quantity they may serve to arouse a flagging appetite, secure the consumption of food when too little variety is available, or when it is inferior in quality, or stimulate a depressed digestive system to the point of digestive activity, as cayenne rouses the adynamic stomach of the drunkard. In such cases, when salt alone has failed to correct the undesirable condition, and change of staple diet is impossible, a condimental mixture may be helpful."

Inspection of feeding stuffs (*New York State Sta. Bul. 280, pp. 233–260*).—The feeding stuffs examined during the fall of 1905 and the winter of 1905–6 under the State law included cotton-seed meal, linseed meal, gluten meal and feed, corn bran, malt sprouts, dried brewers' grains, hominy feeds, mixed wheat offals, compounded feeds, meat meals and similar animal products, compounded

poultry foods, dried molasses beet pulp, dried beet pulp, barley meal, oat by-products, and alfalfa meal.

Commercial feeding stuffs, H. J. WHEELER ET AL. (*Rhode Island Sta. Bul. 112, pp. 77–96*).—Under the provisions of the State law analyses were made of a number of samples of cotton-seed meal and feed, linseed meal (old and new process), gluten meal and feed, brewers' and distillers' grains, malt sprouts, wheat middlings, wheat bran, mixed wheat feeds, hominy meal, corn meal, horse feed, dairy and stock feeds, poultry feed, animal meal and bone, provender, alfalfa meal and molasses, alfalfa meal, sugar feed, crushed oats, dried beet pulp, oat feeds, and proprietary feeds.

"Consumers are again cautioned to beware of ground feeds other than genuine corn meal, wheat middlings, bran, and mixtures of the last two, unless they are guaranteed. The law does not require that these be sold under a guaranty. Consumers are equally cautioned to read the guaranties, for cotton-seed meal containing only about 23 to 24 per cent of protein is guaranteed, as is also that containing from 38 to 43 per cent. Adulterated 'mixed feed' is also on the market containing only from 12 to 13 per cent protein, while the genuine mixed feed, composed of pure wheat bran and middlings, usually contains from 15 to 18 per cent of protein."

Inspection of concentrated commercial feeding stuffs, F. W. WOLL and G. A. OLSON (*Wisconsin Sta. Rpt. 1905, pp. 374–377*).—A table is given showing the proportions of protein and fat in 61 brands of commercial feeding stuffs licensed for sale in the State.

Coefficients of digestibility of American feed stuffs. Experiments made in the United States, J. B. LINDSEY and P. H. SMITH (*Massachusetts Sta. Rpt. 1905, pp. 224–248*).—A summary of digestion experiments which have been made with farm animals at the experiment stations in the United States.

Analyses of oats, C. F. JURITZ (*Rpt. Senior Anal. Cape Good Hope, 1905, pp. 34–36*).—Ash, lime, and phosphoric acid in original material, and lime, phosphoric acid, and carbon and silica in ash are reported for samples of oats from Algeria, South America, Canada, Australia, and Cape of Good Hope.

These analyses were made in view of a complaint that the colonial oats were unsuited for feeding horses on account of a deficiency of lime. The analyses show no foundation for this belief. The percentage of lime in the 5 samples of oats varied from 0.054 to 0.147, the phosphoric acid from 0.441 to 0.734.

Do white moss and white-moss peat possess any feeding value? H. VON FEILITZEN (*Svenska Mosskulturför. Tidskr., 20 (1906), No. 1, pp. 77–79*).—The author summarizes earlier investigations in regard to the feeding value of peat and gives the following analysis of dry sphagnum moss (*Sphagnum cuspidatum*), calculated to a dry-matter basis: Protein 6.62 per cent, fat 0.99 per cent, nitrogen-free extract 65.51 per cent, crude fiber 23.89 per cent, pentosans 15.70 per cent, and ash 2.99 per cent. The amid nitrogen was 20.8 per cent, the digestible albuminoid nitrogen 6.6 per cent, and the indigestible nitrogen (nuclein) 72.6 per cent of the total nitrogen. Carbohydrates yielding mannose, galactose, dextrose, levulose, and pentoses on hydrolysis were found in sphagnum and sphagnum peat, but quantitative determinations were not made of these polysaccharids. The feeding value of the sphagnum moss is shown to be very low.—F. W. WOLL.

Speltz and millet for the production of baby beef, J. W. WILSON and H. G. SKINNER (*South Dakota Sta. Bul. 97, pp. 61–74, figs. 8*).—The relative value of speltz, oats, millet, and corn for calves raised on separator milk and for yearlings on pasture was studied, as well as the practicability of fattening yearlings for the production of baby beef. Hay was fed in addition to the grain.

Each lot contained 2 steers and a spayed heifer and the test as a whole

covered 431 days. The gain ranged from 1.47 lbs. per head on millet to 1.84 lbs. on corn.

"The best gains were made with the ground millet during the fattening period, being 1.76 lbs. per head daily, while the lot fed on corn meal produced 2.8 lbs. per head daily during this period. . . .

"Speltz produces a hard fat, about the same as oats; and as good a quality of meat as corn. . . .

"Fat made by Black Veronesh millet seed was much softer to the touch than that made by either corn, oats, or speltz. When fed as a fattening ration, this variety of millet seed seems to be more like oats than corn. This is shown by the fact that the lot fed on oats required practically the same quantity of hay per pound of gain as did the lot fed on millet. . . .

"It required 0.37 of a pound more of ground millet seed than it did ground corn to produce a pound of gain on calves fattened for baby beef. . . .

"With the exception of the speltz lot, the spayed heifers brought the same price as the steers. . . .

"Ground oats proved to be a profitable feed for the production of baby beef. From a careful examination of the lots before shipping these steers were nearly as fat as those fed on corn. . . .

"When the calves were fed in lots on the same kind of grain from birth to maturity those which received the most highly carbonaceous grain produced the largest per cent of dressed meat. . . .

"In feeding calves for the production of baby beef the following prices were obtained per bushel for grains used: Corn 47 cts., oats 26 cts., millet 38 cts., and speltz 33 cts."

Digestion experiments with wethers. Alfalfa and native hay, H. G. KNIGHT, F. E. HEPNER, and G. E. MORTON (*Wyoming Sta. Bul. 69, pp. 42, figs. 4*).—The digestion experiments reported gave the following average results:

Digestibility of alfalfa and native hay—Experiments with wethers.

Kind of feed.	Number of tests.	Dry matter.	Protein	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Second cutting alfalfa	5	64.50	79.63	43.32	46.23	75.53	55.35
First cutting alfalfa	2	60.39	76.33	35.29	44.37	71.80	45.85
Native hay	2	64.64	56.26	41.59	69.96	68.04	30.63
Native hay (sedges, rushes, grasses)	1	63.21	59.06	62.87	65.09	64.12	53.04

"Wyoming alfalfa hay runs higher in crude fiber and crude protein than the average. The digestion coefficients of the crude protein is also high. The nutritive ratio of first-cutting alfalfa is 1:3.19; second cutting for both years, 1:3.68. Second-cutting alfalfa is apparently a better feed. . . .

"The native hays of Wyoming are better and more nutritious than timothy grown in the Eastern States."

Analyses were made of the above-mentioned feeding stuffs, and in view of the fact that alfalfa is more difficult to cure than some other hays in wet seasons detailed studies were also made of the water extract of alfalfa and native hay as it was thought that this material might bear some relation to the difficulty experienced in curing alfalfa hay, particularly in damp weather. The total water extract of alfalfa hay on an average amounted to 27.43 per cent, of which 5.93 per cent was ash and 21.50 per cent organic matter. In the case of native hay (western wheat grass) the total water extract was 22.23 per cent, the ash and organic matter being, respectively, 2.58 and 19.65 per cent. In the case of

native hay (wire grass) the total water extract was 18.84 per cent and the ash and organic matter 3.79 and 15.05 per cent, respectively.

"Such a large percentage of soluble nutritious material as is present in alfalfa make it an excellent subject for bacterial attack and subsequent fermentation when dampening during the process of drying. This may be one important reason for the ease with which alfalfa discolors and ferments, compared with other well-known and much-used forage."

The value of various grain rations for fattening wethers, G. C. HUMPHREY and F. KLEINHEINZ (*Wisconsin Sta. Rpt. 1905, pp. 39–52, figs. 4*).—Three series of tests are reported, made in each case with 4 lots of 4 animals. In the first test lot 1 was fed cracked corn and whole oats 1 : 1; lot 2, cracked peas and whole oats 1 : 1; lot 3, cracked wheat and whole oats 1 : 1; and lot 4, whole oats. In the other tests the rations were the same, except that barley was substituted for cracked wheat with lot 3. In all cases the grain was supplemented by pasture, hay, cabbage, and roots. The tests have covered 14–18 weeks.

Considering the series as a whole, the average weekly gain on corn and oats was 2.7 lbs. per head, on peas and oats 2.53 lbs., on barley and oats 2.32 lbs. (2 tests only), and on whole oats 2.34 lbs., the cost of food per pound of gain ranging from 4.5 cts. on corn and oats to 6.69 cts. on peas and oats. In the first year's trial the weekly gain on wheat and oats was 2.64 lbs. per head and the cost of food per pound of gain 5.26 cts. The lots were each year exhibited at the International Stock Show and were awarded a number of prizes.

"The results of this experiment indicate that a mixture of cracked corn and whole oats is the most economical feed and the best for producing mutton of the highest quality.

"The oat ration seems the best for producing firm handling quality without softness or overripeness. Peas and oats are also highly recommended for this purpose, but they proved expensive. Barley and oats gave results that warrant further trial. The single year's test of wheat and oats was not satisfactory."

The production of winter lambs, G. C. HUMPHREY and F. KLEINHEINZ (*Wisconsin Sta. Rpt. 1905, pp. 53–61, figs. 4*).—Six grade ewes, 4 of which showed Dorset blood, pastured during the summer and bred to a Dorset ram, gave birth to 7 lambs. At lambing time the ewes were kept in a warm pen. They were fed bran, oats, and oil meal 20 : 10 : 1 with clover and alfalfa hay, cabbage, roots, and silage.

The lambs were fed alfalfa hay and a mixture of bran, oats, corn meal, and oil meal 4 : 2 : 2 : 1. The average weight of the lambs at birth was 10.7 lbs., the average age when marketed 75.2 days, and average weight before shipping 60.4 lbs. The calculated net profit per lamb was $6.43.

The production of satisfactory winter lambs "requires good housing and a knowledge of feeding and management that will insure rapid development of the lambs from birth until placed upon the market. Such knowledge can be acquired only by experience and studying the conditions and successful operations of others engaged in this occupation."

The trial reported the authors consider successful. "The lambs were all saved, they developed good form and quality, and commanded a good price. The cost of feed was comparatively small, though the quantity and quality was all that could be desired. The ewes were good milkers, and had there been more twins produced, as was the case in former years, the profits would have been still greater.

"In selecting ewes for winter lambs, size, prolificacy, and good milking qualities are essential, as the gains made by the lambs are largely dependent upon

the milk supplied. Dorset ewes are recommended for this purpose, since they breed early, are prolific, and give large quantities of milk rich in fat."

Exercise v. confinement in winter for young wethers, G. C. HUMPHREY and F. KLEINHEINZ (*Wisconsin Sta. Rpt. 1905, pp. 62–64*).—In the test reported, which covered 14 weeks, 14 lambs given outdoor exercise made an average weekly gain of 0.94 lb. per head and required 7.07 lbs. of grain and 27.02 lbs. of coarse fodder per pound of gain. In the case of a similar lot fed on the second floor of the sheep barn and given no exercise the gain was 1.04 lbs. per head per week, the grain eaten per pound of gain 6.69 lbs., and the coarse fodder 25.57 lbs. The cost of feed per pound of gain in the 2 cases was 12.7 and 12 cts., respectively. Both lots were fed similar rations of mixed hay, mangels, and corn, oats, and bran 1 : 2 : 1.

Summarizing this and earlier tests (E. S. R., 16, p. 807), the authors state that the average weekly gain per lamb with exercise has been 1.2 lbs. and without exercise 1.3 lbs., and the cost of gain in the 2 cases 12 and 11 cts.

"The results of these 3 trials lead one to believe that for feeding growing wethers, close confinement in pens which are dry, with fresh air and light, is equal to, if not somewhat better, than allowing plenty of exercise. It is believed that there is much space in the farm buildings throughout the State which could be utilized for feeding a greater or less number of wethers. No better class of stock can be recommended for converting farm grains and roughage into cash and fertilizers than sheep. The farmer who has feed and unoccupied space in barn driveways, emptied mows, or stair lofts, can utilize the same to a good advantage by feeding sheep."

The value of soy beans in grain rations for lambs, G. C. HUMPHREY and F. KLEINHEINZ (*Wisconsin Sta. Rpt. 1905, pp. 65–68*).—Continuing earlier work (E. S. R., 16, p. 807), a ration of soy beans and shelled corn 1 : 1 was compared with a similar mixture of oats and shelled corn.

The 9 lambs fed the soy-bean ration made a total gain of 119 lbs. during the 12 weeks of the test as compared with 71 lbs. in the case of the corn and oats ration. The grain eaten per pound of gain in the 2 cases was 6.35 and 10.62 lbs., respectively, and the coarse fodder 10.51 and 16.65 lbs. The lambs fed soy beans produced 95.1 lbs. of wool and those fed oats 81.3 lbs.

From this and earlier work the authors conclude "that soy beans are an economical supplement to corn for gains with sheep both in body weight and wool production. The increase in wool produced was 13.8 lbs., which sold for 30 cts. per pound, increasing the profits by $4.14."

The feeding stuffs used were analyzed.

Summary of pig feeding experiments, F. B. LINFIELD (*Utah Sta. Bul. 94, pp. 27–62*).—Feeding tests with pigs are reported and general deductions are drawn from the investigations which have been carried on since 1890 at the station.

In continuation of earlier work (E. S. R., 10, p. 986) the value of dairy by-products for fattening was studied. In a test made with 2 lots of 3 pigs each and 1 lot of 4 pigs the average daily gain in 76 days on grain alone was 0.67 lb. per head; on grain and skim milk 1 : 10, 1.43 lbs., and on grain and skim milk 1 : 5, 1.62 lbs.

In the second test, which covered 87 days, 8 lots of 3 pigs each were used and skim milk or whey alone, grain alone, and grain and skim milk or whey in large and small amounts were tested. Three lots were fed in pens, the others on pasture. The gain on pasture ranged from 0.67 lb. per head on skim milk only to 1.25 lbs. on a full ration of grain and skim milk. In pens the gain ranged from 0.75 lb. on grain alone to 1.35 lbs. on a full ration of grain and skim milk.

Considering both tests the dry matter eaten per pound of gain ranged from 2.03 lbs. with pastured pigs fed skim milk or whey alone to 4.45 lbs. with pigs fed grain alone. In general, the lots fed skim milk and grain made larger gains than those on skim milk alone or grain alone and those fed in pens more than similar lots in pasture.

The feeding was continued for 16 days with 4 of the lots used in the second test to secure data regarding the influence of previous methods of feeding on subsequent gains. All the lots were fed a full-grain ration with skim milk and whey. The lot previously fed a half-grain ration on pasture made the most rapid gain, 2.06 lbs. per day, "and made the gains at a smaller cost in grain for each pound of gain." The lot previously fed skim milk alone on pasturage made the smallest gain, 1.77 lbs. per head per day, and made the gains least economically.

"Skim milk alone would appear not to be so good a preliminary feed for fattening hogs, as the gains were not so rapid nor so economical in any of the stages of fattening as when the hogs were fed a half-grain ration on pasture."

To test the value of whole milk 3 young pigs averaging 41 lbs. each were fed this material for 50 days, some grain being given the last week of the period. The average gain was 0.867 lb. each, 13.25 lbs. of milk and 0.18 lb. of grain being required per pound of gain. After an interval of 13 days on pasture the feeding was resumed and the pigs were given milk and grain 3:1 for 30 days. The average daily gain was 1.89 lbs. each, 5.12 lbs of milk and 1.71 lbs of grain being required per pound of gain. The author calculates that when fed with grain whole milk has twice as great a value as when fed alone.

"Compared with trials with skim milk, 100 lbs. of whole milk displaces on the average about twice as much grain as 100 lbs. of skim milk, or, in other words, 50 lbs. of whole milk is equal to 100 lbs. of skim milk as a feed for hogs when both are fed with grain as a part of the ration.

"The above is, of course, the result of but one trial and may be modified by future tests."

The general conclusions regarding skim milk, which were drawn from the station experiments as a whole, follow:

"For the most rapid gains, and therefore the greatest economy in time and labor, a ration of grain and skim milk in the proportion of 1 lb. of grain to 5 of skim milk for young animals and 1 to 3 for older animals has given us the best results. When the animals were fed in pens we got the most rapid gains, but when on pasture slightly the most economic gains. Thus whether to feed in pasture or in pens is a matter to be determined more by the circumstances of the feeder than by any great advantage in either method.

"When the price of grain is high, slower but more economical gains are made by feeding a small quantity of grain and giving all the milk the hogs will eat. When so fed considerably better results are obtained by feeding on pasture than in pens.

"Hogs will gain fairly well on a ration of skim milk alone, but we have found it difficult to keep them in good health when so fed in pens. When this ration is fed on pasture the hogs keep in better health, gain a little more rapidly, and make more economical gains. Such a ration is not to be recommended when grain can be obtained at a reasonable price."

As regards the value of different grains, the conclusion drawn from the Utah work is that wheat has proved the most effective as regards both rapidity and economy of gain. Corn meal and barley have proved to have much the same value, barley being somewhat superior on the basis of weight of the pigs. It also appears that the best results were obtained, as regards both the rapidity and economy of gain, when pigs were given grass, or allowed to run

on pasture, or when fed skim milk with a grain ration. In the winter season pigs should be fed in a dry pen, but they will make faster and more economical gains if they have access to a little alfalfa hay.

Whole corn compared with corn meal for fattening pigs, W. A. Henry (*Wisconsin Sta. Rpt. 1905, pp. 16–20*).—Five pigs fed equal parts of heavy wheat middlings and corn meal mixed to a slop with water gained 106 lbs. in 14 weeks, 5.77 lbs. of grain being required per pound of gain, as compared with a gain of 123.6 lbs. per head in the case of a similar lot fed a mixture of equal parts of dry wheat middlings and shelled corn, 5.23 lbs. of grain being required per pound of gain.

Summarizing the present test and earlier investigations (E. S. R., 16, p. 808), the average gain on the dry ration has been 96.8 lbs. per head and the feed eaten per pound of gain 5.18 lbs. Similar values on the ground corn and wheat middlings ration have been 110.9 lbs. and 4.88 lbs. Grinding the corn, according to the author, effected a saving of 5.7 per cent. The advisability of grinding is determined by the price of corn and the cost of grinding.

"When corn is worth only 25 cts. per bushel the saving from grinding amounts to only 1.4 cts., not enough to pay for the grinding unless cheap power is available. As corn advances in price it will be noticed that the saving per bushel increases practically three-tenths of a cent with each 5 cts. advance in the price of corn. Should the price of corn be as high as 75 cts. per bushel the saving by grinding would amount to a little over 4 cts. per bushel."

Soy beans v. wheat middlings as a supplement to corn meal for growing and fattening pigs, G. C. Humphrey (*Wisconsin Sta. Rpt. 1905, pp. 21–30, pl. 1, figs. 2*).—In continuing the work of the previous year (E. S. R., 16, p. 809), 5 pigs were fed corn meal and soy-bean meal 2 : 1, while a similar lot was fed corn meal and wheat middlings in the same proportion, both lots being given some skim milk.

During the 27 weeks of the test the average gain per head on the soy bean meal ration was 1.37 lbs. and on the wheat middlings ration 1.24 lbs., the grain consumed per pound of gain in the 2 cases being 3.75 and 4.14 lbs., and the skim milk 3.9 and 4.31 lbs. As shown by slaughter tests with 2 animals from each lot, the dressed weight on soy beans was 82.85 per cent of the live weight and on wheat middlings 84 per cent. Other data are recorded.

The conclusions drawn from the tests were in effect as follows: Soy beans make an excellent supplement to corn meal for growing and fattening pigs and are a little over 10 per cent more valuable than wheat middlings for pork production. In feeding equal amounts of the two rations, the soy beans and corn meal supply a slightly higher percentage of dry matter and digestible matter than the wheat middlings and corn meal. For firmness, fine grain and texture of flesh, and even distribution of fat and lean, the ration of wheat middlings and corn meal is superior to that of soy beans and corn meal.

Feeding cotton-seed meal to swine, J. G. Fuller (*Wisconsin Sta. Rpt. 1905, pp. 31–36*).—In the first trial reported a ration of equal parts of corn meal and cotton-seed meal mixed to a thick slop was fed to a lot of 5 pigs, while a similar lot was fed the same mixture soaked in water for 48 hours so that it had become thoroughly soured.

At first the gains were satisfactory, but about the middle of the 10 weeks' test the pigs began to lose their appetite and for the last 4 weeks they lost flesh and 2 in each lot died late in the test or after it closed. The total gain on the fresh cotton-seed ration was 131 lbs. and on the sour cotton-seed ration 139 lbs.

In a second test, made under practically the same conditions and covering 6 weeks, the total gain made by 5 pigs was 41 lbs. on fresh cotton-seed meal and 39 lbs. on sour cotton-seed meal. In this test also the gains were satisfactory

until the sixth week, when 1 pig fed the fermented cotton seed died and the condition of the remainder was such that the experiment had to be discontinued. Two pigs died a few days afterwards. In this and the preceding test post mortem examination showed that the vital organs were affected, as has been noted in other experiments with cotton-seed meal.

In the third trial, which was made with 2 lots of 7 pigs each, the ration consisted of nine-tenths corn meal and one-tenth cotton-seed meal fed in comparison with corn meal and wheat middlings 1 : 1, the grain in both cases being supplemented by skim milk. In 9 weeks the pigs fed cotton-seed meal gained 332 lbs. and those fed wheat middlings 169 lbs. In the fifth week of the test one of the pigs fed cotton-seed meal died, but post-mortem examination showed none of the conditions present in the other trials.

"From these trials there is no encouragement for the farmer, under our present knowledge, to feed cotton-seed meal to swine. While it is used quite generally for dairy cows, and, in certain localities, is fed in large quantities to fattening cattle, it may prove fatal to swine when fed even in relatively small quantities."

Middlings and ground barley v. middlings and corn meal as a grain ration for young sows, J. G. FULLER (*Wisconsin Sta. Rpt. 1905, pp. 37, 38*).—Six young sows fed equal parts of wheat middlings and ground barley mixed with skim milk made a total gain of 643 lbs. in 15 weeks, the total amount of grain and skim milk eaten being 3,370 and 4,008 lbs., respectively. An equal number of sows fed wheat middlings and corn meal 1 : 1 with skim milk gained 730 lbs. and consumed a total of 3,342 lbs. of grain and 4,008 lbs. of milk.

The inferior gain made on the ground-barley ration was attributed to the fact that one of the pigs lost weight rapidly toward the close of the test. With this exception the animals in both lots were in excellent condition at the close of the trial.

The location, construction, and operation of hog houses, W. DIETRICH (*Illinois Sta. Bul. 109, pp. 286–302, figs. 6*).—The location and construction of hog houses are discussed and mehtods of operating a hog house planned and built at the station, which meets the requirements indicated, are given.

According to the author's summary—

"A hog house should be located so that it is well drained, well lighted, and gives access to pasture, good shade, pure running water, and clean mud wallows.

"The two principal kinds of hog houses are the individual houses and the large houses with individual pens. Each has its points of advantage.

"For sanitation the building should be constructed so that it is dry, ventilated, free from dust and drafts and so that the direct rays of the sun fall upon the floor of the pens at the time the winter crop of pigs is farrowed. These rays should also be excluded during the summer.

"The building should be made serviceable by being built so that it can be used every day in the year and be arranged so that the largest amount of work may be performed with the smallest amount of labor.

"For large houses gates and partitions made of wire are best because they do not obstruct the light and heat rays from the sun, do not hide the pigs from view of the attendant, nor from each other, and do not furnish lodgment for disease germs.

"The large hog house is operated so that two litters per year are farrowed and grown for market and so that the pigs are put on the market at the most favorable season.

The fecundity of Poland China and Duroc Jersey sows, G. M. ROMMEL (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 95, pp. 12*).—The examination of Poland China record books indicates an increase of 0.48 per litter for 20

years, an increase which the author points out would not be of great importance when hogs are raised for the butchers' trade, but which represents a very substantial increase to the value of the breed considered from a breeding standpoint.

Considering American and Ohio Poland China records for 1898 to 1902, the average sized litter is 7.52. The records for Duroc Jersey sows showed differences too small to have any particular importance as regards increase or decrease in fecundity. The average size of litters for 10 years covered by the records consulted is 9.26. These results confirm common observation—that Duroc sows are more prolific that Poland Chinas."

Laws pertaining to horse breeding in Wisconsin (*Wisconsin Sta. Rpt. 1905, pp. 379–382*).—The text of the laws enacted April 22, 1905, regulating the public service of stallions in Wisconsin is quoted.

Ostrich farming in Arizona, W. Pickrell (*U. S. Dept. Agr. Yearbook 1905, pp. 399–406, pls. 3*).—An historical account is given of ostrich farming in Arizona and general problems concerned with ostrich raising are spoken of, such as egg laying and incubation, feeding and care of the chicks, plucking and sorting feathers, handling and feeding ostriches, and the possible profits of the ostrich industry.

Young ostriches, according to the author, are usually kept in troops of 25 to 50, and when a year old the males should be separated from the females. When 3 years old the birds should be paired and each pair placed in a separate inclosure. If they are to graze on alfalfa or other green feed, the inclosure should be large enough to supply them all they need. If given dry feed, the inclosure need only be large enough for exercise.

"One of the very best feeds for ostriches is alfalfa. One acre of good alfalfa in Arizona will maintain 4 ostriches without their receiving any additional feed. When pastured or fed on green alfalfa they are always healthy. . . .

"Ostriches thrive well on any tender green forage, and they prefer the kind they have been taught to eat. Birds fed on hay, when turned out, often refuse to eat grass until they become very hungry.

"For dry feed, alfalfa or clover hay cut up, mixed with bran, and moistened is excellent. An ostrich will consume about 3 lbs. of hay and 1 lb. of bran daily. They should have gravel and broken bone at all times. Occasionally an ostrich will get a piece of bone lodged in its throat. In such case, if the bone can not be worked up or down by external manipulation, the throat may be cut, the bone removed, and the incision sewed up. It will heal very quickly.

"Ostriches may be fed any kind of grain—corn, wheat, barley, oats, or peas. Some farmers feed a little grain while the birds are nesting. Ordinarily, however, if ostriches are in good flesh and have plenty of good green feed they need no grain. Besides, if fed much grain they are liable to become cross and hard to manage."

As regards ostrich farming as a profitable industry, the author points out that an acre of alfalfa will keep 4 birds, yielding annually 1.5 lbs. of feathers with an average value of $20 per pound, and 36 to 90 eggs, weighing 3.5 lbs., which may be used for incubation or for food, and if the ostriches are sold, which is rarely the case, the price ranges from $100 for 6 months old birds to $800 or more per pair at 4 years.

Ostriches are too valuable for food purposes at present, but it is pointed out that the flesh is said to be much relished by those who have eaten it, while the eggs are palatable when made into omelets, etc.

Poultry experiments, W. P. Brooks, F. R. Church, and S. B. Haskell (*Massachusetts Sta. Rpt. 1905, pp. 43–46*).—Wheat and corn supplemented by animal meal were compared with 2 lots, the ration in both cases being charac-

terized by high fat and ash content and a low fiber content. Sufficient corn oil was added to the wheat ration to make the total fat in the 2 rations practically the same.

In the first period, March 2 to May 12, the relative egg production on wheat was at the rate of 39 eggs and on corn 45 eggs per day per 100 hens, the cost per egg being 1.036 and 0.749 cts., respectively.

In the second period, May 13 to September 23, the egg production on wheat was at the rate of 31 eggs and on corn 41 eggs per day per 100 hens, the cost per egg being 0.895 and 0.703 ct., respectively. These results, it is pointed out, are in accord with those of earlier years (E. S. R., 17, p. 283).

In the second test wheat and corn were compared, milk albumen being used as a source of animal food, and corn oil being added to the wheat ration to make the fat content of the 2 rations alike. Both rations were characterized by relatively high ash content and low fiber content and by a fat content lower than in the first test.

In the spring period the egg production was at the rate of 41 eggs per day per 100 hens on wheat and 39 eggs on corn. Similar values for the summer period were 35 eggs on wheat and 31 eggs on corn. The cost of food per egg in the spring period on wheat was 1 ct. and for the summer period 0.845 ct., and on corn 0.942 and 0.871 ct., respectively.

The experiment indicates "that, unless the fat content of the ration is relatively high, the more starchy foods are not sufficient to produce a satisfactory egg yield, and the product falls below that obtained from feeding a ration higher in protein."

In the third test the rations were characterized by low protein and high fat and ash content, the grains selected for comparison being oats with oat feed and rice. Beef scraps were used to supply animal food. For the spring period the average egg production for the oat ration (high fiber content) was 40 eggs per day per 100 hens and for the rice ration (low fiber) 42 eggs. Similar values for the summer period were 38 and 46 eggs. The cost of food per egg on the oat ration was 1.019 cts. for the first period and 0.935 ct. for the second period, and for the rice ration 1.103 and 1.048 cts., respectively.

As heretofore (E. S. R., 17, p. 283), the rice ration gave a very satisfactory egg yield, but it is so high in price that it can not be fed economically. It was selected for experimental purposes on account of its low fiber content, and results indicate very clearly that a small amount of fiber is unfavorable.

The nutritive ratios in the food combinations used ranged from 1:4.03 in one of the wheat rations to 1:6.69 in one of the corn rations. "Our experiments clearly do not support the view that a narrow nutritive ratio is essential to good egg production."

Raising chicks artificially, J. H. STEWART and H. ATWOOD (*West Virginia Sta. Bul. 98, pp. 171–184, pls. 4*).—Much attention has been devoted at the station to the incubation and brooding of chickens, and on the basis of the data secured and other available information directions are given for managing incubators, brooding chicks, feeding, care, and similar topics.

The necessity for a satisfactory incubator, which is durable, is pointed out, and the authors are in favor of hot-air machines because they are less troublesome to manage.

"It is a very bad plan to use eggs for incubation which have been produced by hens that have been fed heavily during the winter for egg production. Under these conditions the vigor of the hens, when spring comes, is apt to be reduced, and even though the eggs may hatch fairly well, the chicks are apt to be weak and puny. The breeding stock must be vigorous in order to produce the right sort of eggs. . . .

"During the first two or three days after the chicks are hatched they require warmth and the opportunity to gain strength rather than to receive food. They should be supplied with water, however, and it will do no harm if they have a little fine chick grit at which to peck. . . .

"During the past few years we have found that by raising chickens in a piped brooder house and then transferring them to colony houses the labor of attending to individual brooders is not only avoided, but the chicks have been healthier and more of them have been raised to maturity. Outdoor brooders have not been successful. They are difficult to attend to in stormy weather, and in a few years become old and out of repair, and if indoor brooders are to be used on any considerable scale it seems wiser to construct a piped brooder house kept warm by a heater burning coal or gas rather than to bother with a number of individual lamps, each of which is almost of as much trouble to attend as the large heater."

The value of skim milk for laying hens, J. H. STEWART and H. ATWOOD (*West Virginia Sta. Bul. 102, pp. 265–277*).—Two tests are reported of the value of skim milk *v.* water for wetting a feed mash.

In the first test, which covered 122 days, 22 hens fed skim milk laid 1,244 eggs as compared with 996 eggs laid by the 22 hens fed mash wet with water.

In the first period of the second test 60 hens fed the skim-milk ration laid 862 eggs in 37 days as compared with 632 eggs laid by a similar lot fed no skim milk. In the second period, which covered 56 days, the rations were reversed. The chickens fed skim milk laid 1,220 eggs as compared with 978 in the case of the lot fed no skim milk. In every case the pens contained 1 cock to 10 hens.

"In both experiments more eggs were produced when skim milk was substituted for water for moistening the mash.

"Under the conditions prevailing in these experiments and with eggs selling for 20 or 25 cts. per dozen the skim milk used for moistening the mash had a feeding value of from 1½ to 2 cts. per quart.

"In these trials 802 qts. of skim milk were fed, resulting in an increase in the egg production of 702 eggs."

A comparison of White Leghorn and mongrel hens for winter egg production showed that under similar conditions 50 mongrels in a year produced 4,807 eggs as compared with 5,824 eggs laid by the blooded stock. Both lots were handled alike, receiving the ordinary care and attention which would be given on an average farm. In addition to the skim milk used to moisten the mash the Leghorns consumed 61 lbs. of food costing 85.3 cts. as compared with 66.8 lbs. of the same materials costing 92.1 cts. which was consumed by the mongrels. The calculated profit from the eggs was $1.39 for the Leghorns and 86 cts. for the mongrels. "The mongrels gained in weight 1 lb. per head more than the Leghorns. If this increase in weight is taken into consideration, then the Leghorns gave a profit of 40 cts. per hen more than the mongrels."

The highest prices for fresh eggs are usually obtained from November to March. "During these 4 months the mongrels laid only 364 eggs and the Leghorns 1,029, or practically three times as many."

In the authors' opinion the experimental data recorded in this test furnish some evidence regarding the error incident to experiments of this character.

"These results indicate that in poultry experiments of this class in which 25 or more fowls are used in each lot the results of a 6 months' trial will be practically as accurate and reliable as though the test were continued for an entire year. Also that the error, almost inseparably connected with experiments of this nature, should not exceed 3 per cent after the test has been conducted for 4 or 5 months."

Inheritance in poultry, C. B. DAVENPORT (*Washington: Carnegie Institution of Washington, 1906, pp. 136, pls. 17, figs. 4*).—An elaborate series of experiments in poultry breeding carried on at the Cold Spring Harbor Station for Experimental Evolution led to a number of general conclusions from which the following are quoted:

"Poultry exhibit numerous unit characteristics which do not blend in hybridization, but are inherited in alternative fashion. The unit characters are not immutable things in hybrids, but subject to modification—perhaps permanent—by interaction of the alternative characters.

"Although the great majority of characteristics of poultry are inherited alternatively, yet a few cases of color characters show a particulate inheritance. The comparative rarity of blending of characters makes it easier to see how new characters will not be 'swamped by intercrossing with the parent form.'

"Specific and varietal characteristics in de Vries's sense are not inherited in a markedly different fashion, although in 2 cases progressive variants do not Mendelize typically.

"The patent characteristic is usually dominant over its latent allelomorph. Old and new characteristics are equally dominant. Dominance and recessiveness of characteristics are not always accompaniments of their segregation in the germ cells; both, moreover, are frequently incomplete. Dominance is usually, but not always, independent of the races crossed. Prepotency is as truly important in inheritance as dominance. . . .

"Reciprocal crosses exhibit differences due to the fact that the father and the mother transmit different kinds of characteristics. . . .

"The proportion of the 2 sexes in hybrids is normal. With few exceptions correlated characteristics easily separate as a result of hybridization so that any conceivable combination may be effected."

DAIRY FARMING—DAIRYING.

Feeding experiments with milch cows, J. H. STEWART and H. ATWOOD (*West Virginia Sta. Bul. 106, pp. 335–345, pl. 1, fig. 1*).—Two experiments are reported in which the economy of feeding more silage and hay and less grain was studied. The first test included 8 cows and lasted 20 days, and the second, 7 cows and lasted 45 days.

"Realizing that definite conclusions can not be drawn in feeding trials of this nature from 2 short tests, yet these experiments indicate that when a dairyman has plenty of good corn silage it will not be wise to feed more than 5 or 6 lbs. per day of a mixture of cotton-seed meal and wheat bran to cows of the average size employed in this test."

Dried-beet pulp or molasses-beet pulp for dairy cows, F. W. WOLL and G. C. HUMPHREY (*Wisconsin Sta. Rpt. 1905, pp. 108–117*).—Brief notes are given on the production of these 2 feeding stuffs and feeding experiments with cows are reported. The ration used for comparison consisted of 5 lbs. of hay, 35 to 40 lbs. of silage, and about 8 lbs. of a grain mixture consisting of wheat bran, distillers' grains, and cotton-seed meal in the proportion of 2 : 2 : 1. Dried-beet pulp or molasses-beet pulp was substituted for the wheat bran in the ratio of 3 : 2 by weight. Two tests were made, the first including 15 cows and the second 6.

When wheat bran was replaced by dried-beet pulp in the proportion indicated there was no appreciable difference in the effect of the 2 rations. Molasses-beet pulp substituted in the same manner produced, however, about 12 per cent more milk and 8 per cent more butter fat. Beet pulp showed a tendency

to decrease the fat content of the milk. The results, therefore, indicate that when wheat bran is valued at $18 a ton, dried-beet pulp is not worth over $12 and molasses-beet pulp over $13 a ton.

Bibby's dairy cake, J. B. Lindsey (*Massachusetts Sta. Rpt. 1905, pp. 79–85*).—Digestion experiments with sheep and feeding experiments with cows were made to determine the value of this proprietary feeding stuff which is said to be composed of cotton seed, carob beans, corn, wheat, fenugreek, salt, etc. The material was found to resemble in composition and digestibility standard wheat middlings. At prevailing market prices it is not regarded as an economical feeding stuff.

It is believed that farmers will do well to produce their hay, silage, and corn meal and purchase only those feeding stuffs that are rich in protein, such as cotton-seed meal, gluten feed, distillers' grains, brewers' grains, wheat middlings, and bran.

Concerning wheat bran, J. B. Lindsey (*Massachusetts Sta. Rpt. 1905, pp. 94–114*).—Notes are given on the composition, digestibility, and fertilizing ingredients of wheat bran as compared with other concentrated feeding stuffs, and 2 feeding experiments with cows are reported. The roughage in the 2 rations compared consisted of hay and silage and the grain feed of cotton-seed meal and flour middlings. To this was added either bran or silage with corn meal or corn-and-cob meal. In one of the experiments the results were slightly in favor of the bran ration, while in the other the so-called silage ration gave the best results.

The author concludes that for small herds the quantity of purchased grain may be reduced to 3 to 4 lbs. daily by substituting home-grown corn in place of wheat bran. It is suggested that the grain mixture may consist of 1½ lbs. cotton-seed meal, 2 lbs. flour middlings, and 2½ to 3 lbs. corn meal or corn-and-cob meal. Malt sprouts may be substituted for the wheat, oats, or rye middlings. Where the feeding can not be closely supervised and where it is desired to feed more than 5 to 7 lbs. of grain daily, it is considered advisable that the grain mixtures should consist of one-third to one-half of wheat bran.

The addition of salt to the ration of dairy cows, S. M. Babcock (*Wisconsin Sta. Rpt. 1905, pp. 129–156, pls. 2*).—This article contains a review of the literature of this subject and the results of experiments conducted in 1889, and again in 1899 and 1900.

The purpose of the experiments was to determine the amount of salt in addition to that obtained in feed and water necessary to maintain the health of cows and the normal flow of milk. In each of the 3 trials conducted the cows showed an abnormal appetite for salt after having been deprived of it for 2 or 3 weeks, but did not appear to be affected in health until a much longer period, varying in individual cases from less than 1 month to more than 1 year. In all cases cows deprived of salt finally reached a condition of low vitality from which recovery was rapid when salt was supplied.

The results, however, indicated that when cows are not giving milk they may be maintained in good health for an indefinite period with no salt other than that contained in normal rations. It is estimated that the daily ration fed contained the equivalent of 0.75 oz. of salt, which is assumed as the minimum amount required per 1,000 lbs. live weight for an animal not producing milk.

Cows giving milk should therefore receive in addition enough salt to compensate for the chlorin in the milk, which is estimated as equivalent to 0.6 oz. of salt for each 20 lbs. of milk. As a slight excess will do no harm it is recommended that cows be given at least 1 oz. of salt per day. It is considered evident, however, that the amount of additional salt required will vary greatly in different localities.

The length of time required in these experiments for demonstrating the injurious effects of depriving cows of salt raises the question in the mind of the author if the periods usually employed in feeding experiments have been sufficiently long to show the physiological effect of any particular food.

Influence of dehorning and tuberculin testing on the milk secretion of dairy cows, F. W. Woll and G. C. Humphrey (*Wisconsin Sta. Rpt. 1905, pp. 118–124*).—Fourteen cows were subjected to the tuberculin test and then dehorned. The milk of these cows as regards yield and composition was compared with the milk of cows dehorned but not tuberculin tested, of cows tuberculin tested but not dehorned, and of cows neither dehorned nor tuberculin tested. The result showed on an average a decrease of about 8 per cent in the yield of milk for the first few days after dehorning, but a loss of only about 2 per cent in the yield of butter fat. Dehorning, therefore, increased the fat content of the milk 0.27 per cent. These results are noted as being in accord with the results of investigations at other experiment stations which are cited. The tuberculin test was apparently without effect upon milk secretion.

The university dairy herd, 1904–5, G. C. Humphrey and F. W. Woll (*Wisconsin Sta. Rpt. 1905, pp. 69–107, pl. 1, figs. 12*).—Descriptions and illustrations are given of 12 cows added to the herd since the previous report (E. S. R., 16, p. 813), and records of 34 cows for the full year are reported and discussed.

The most profitable cow was a Jersey, which produced 6,790.9 lbs. of milk and 389.87 lbs. of butter fat at a net profit over cost of feed of $61.22. The average production of the 34 cows was 6,439.5 lbs. of milk and 280.57 lbs. of butter fat. The average net profit per head was $35.20. As compared with the previous year, the results show a decrease in average production and in net profit, attributed in part to poorer pasturage and an inferior quality of silage.

The average production of the 34 cows by breeds was as follows: Jersey (6 cows), 5,816.6 lbs. of milk and 315.8 lbs. of fat; Guernsey (9 cows), 5,193.5 lbs. of milk and 270.8 lbs. of fat; Holstein (7 cows), 8,372.5 lbs. of milk and 296.29 lbs. of fat; Shorthorn (6 cows), 6,116.2 lbs. of milk and 234.52 lbs. of fat; Red Polled (4 cows), 7,050.6 lbs. of milk and 290.97 lbs. of fat; and Brown Swiss (2 cows), 6,898.2 lbs. of milk and 281.14 lbs. of fat. The results as regards butter-fat production and net profit were, therefore, favorable to the Jerseys. The data, however, are considered insufficient to warrant general deductions concerning the value of the various breeds.

As in the previous reports, a comparison was made of the cows by types. Twelve cows of the extreme dairy type produced on an average 5,958.6 lbs. of milk and 286.06 lbs. of fat at a profit over cost of feed of $37.92. Ten cows of the large dairy type produced 6,874.5 lbs. of milk and 297.34 lbs. of fat at a profit of $36.39. Twelve cows of the dual purpose type produced 6,558 lbs. of milk and 261.11 lbs. of fat at a profit of $31.49. The average net profit of the 3 types for the period from 1898 to 1905 was respectively $39.08, $39.31, and $35.22. On the whole, the large dairy cows have been the most profitable. It is therefore believed that attention should be given to the matter of size in the selection of dairy animals.

Analyses are given of the feeding stuffs used. A comparison of the ration fed during the year with those of previous years showed a maximum yield and fat content of milk coincident with a narrowing of the ration. It is not believed that a narrower nutritive ratio than 1:6 will be found advantageous except in the case of high producers. It is suggested that the nutritive ratio may profitably range between 1:6 and 1:7, the dry matter from 20 to 24 lbs., and the digestible protein from 2 to 2.4 lbs.

Official tests of dairy cows, 1904–5, F. W. Woll (*Wisconsin Sta. Rpt. 1905, pp. 125–127*).—This is a brief account of 864 tests reported in detail in Bulletin 131 of the station (E. S. R., 17, p. 903).

Market milk, J. B. Lindsey and P. H. Smith (*Massachusetts Sta. Bul. 110, pp. 48, figs. 5*).—Part 1 of this bulletin is a general discussion on the character, composition, and food value of milk.

Part 2 is a résumé of the conditions of milk production observed by the authors during the winter months in the region supplying Amherst and Northampton, Massachusetts. The majority of the stables were found to be dirty, poorly lighted, and badly ventilated. Many of the animals were exceedingly dirty. No herd had been subjected to the tuberculin test. The health of the animals appeared satisfactory in most cases. No fault was found with the water supply in the majority of cases nor to the food supply in any instance from the standpoint of the health of the animals. Modern appliances for the handling of milk were not in general use.

Part 3 gives the results of chemical and bacteriological investigations of 113 samples collected during the period from July to March from milkmen while engaged in retailing the milk. The acidity expressed in degrees or the number of cubic centimeters of tenth normal sodium hydroxid solution required to neutralize 100 cc. of milk varied from 12 to 21.3 and averaged 14.7 on the day of collection, thus indicating that the majority of the samples were not over 12 to 24 hours old when tested. The average composition of 110 samples was as follows: Total solids, 13.23 per cent; fat, 4.49 per cent, and solids-not-fat, 8.74 per cent. In general the samples were above the Massachusetts standard. Only 2 were known to have been watered and 5 were considered somewhat suspicious. All the milk retailed at 6 cts. per quart. Of 101 samples, 50 contained more than 50,000 bacteria per cubic centimeter; 41, more than 100,000; 13, more than 500,000, and 9, more than 1,000,000. The proportion of acid organisms in the majority of the samples varied between 10 and 35 per cent. The liquefying bacteria exceeded 10 per cent in 22 out of 69 samples. A disagreeable odor was detected in 65.5 per cent of the samples, which was considered as due particularly to the habit of allowing the milk to stand exposed to the air of the stable for some time after milking. It is considered clear that a great deal of the milk offered for general consumption was not produced under satisfactory sanitary conditions.

In part 4 the authors make practical suggestions concerning the duties of producers and consumers of milk. When milk testing 4.5 to 5 per cent of fat is produced under reasonably satisfactory sanitary conditions the authors believe that 8 cts. per quart must be obtained in order to secure a fair return from the investment.

Care of milk on the farm and the manufacture of butter and cheese, R. W. Clark (*Utah Sta. Bul. 96, pp. 109–135, figs. 4*).—This is a popular discussion on the sanitary production and handling of milk and improved methods of butter and cheese making with the results of some experimental work.

The author, in conjunction with J. A. Crockett, made some experiments in canning cheese. After pressing in molds the cheese was placed in tin cans holding from 5 to 30 lbs., the cans having been previously paraffined on the inside to prevent rusting. This method prevented loss in weight and lessened the attention required during curing, but increased the cost of the cheese from 1 to 3 cts. per pound. After curing for 90 days canned, paraffined, and unparaffined cheese scored practically the same. The loss in weight of the paraffined and unparaffined cheese was 5.5 and 8.6 per cent, respectively.

In 8 trials paraffined cheese lost 3.7 per cent in weight and unparaffined cheese 7.6 per cent during curing for 3 months at 65° F. The scores averaged

91.45 and 93.95, respectively, for the 2 lots. In further experiments cold storage gave better results than the ordinary curing room for both paraffined and unparaffined cheese. It was estimated that paraffining cheese effected a saving of 22.5 cts. per hundred when cheese was cured from 90 to 100 days at ordinary temperature.

The Babcock test was compared with chemical analysis of 15 samples of skimmed milk, the test being made with about one-fourth more acid than usual and the tester run at a higher speed and several minutes longer than customary. The average results for the 2 methods were, respectively, 0.1 and 0.198. In tests with 4 makes of hand separators, different temperatures of milk and variations in speed of separator bowl were compared. With cold milk and low speed, 0.44 per cent of fat was left in the skim milk as determined by the Babcock test.

"The most satisfactory skimming was secured when the milk had a temperature of about 85° F. and the separator operated according to the directions of the manufacturers."

On the detection of a tainted condition in pasteurized milk, H. L. RUSSELL and C. HOFFMANN (*Wisconsin Sta. Rpt. 1905, pp. 222–226*).—The station was called upon to investigate the cause of an undesirable flavor in the product of a large dairy company which was pasteurizing its milk for the general city trade. The investigation showed that the trouble was due to the custom of passing steam through the pasteurizing machine immediately before the milk was turned into the apparatus. Some of the steam condensed in the machine and this not infrequently contained enough grease or oil to impart an objectionable flavor to the milk. The case is considered interesting as indicating how much trouble can sometimes be caused by an apparently trivial circumstance.

Studies on pasteurization of milk in a "continuous-flow" machine (Miller apparatus), H. L. RUSSELL and C. HOFFMANN (*Wisconsin Sta. Rpt. 1905, pp. 232–241, fig. 1*).—In determining the period of exposure, use was made of the following method, which is believed to have superior advantages over the colorimetric method ordinarily employed:

"The heater is first filled with water. To determine then the minimum period of time necessary for any particle of milk to pass through the machine, the exact time of starting the milk flow is noted, and also the appearance of the first indications of turbidity. This gives the time necessary for the most rapidly flowing particles of milk to pass through the machine. To find the maximum period of exposure, some samples of the milk are taken at the outlet at stated intervals, every 5 or 10 seconds or so, for a period of several minutes. A determination of the fat in these samples is then made.

"When the fat content has been restored to its original amount, it indicates that all of the water in the machine has been replaced by the flowing milk. By charting these fat determinations, not only can the minimum and maximum periods of exposure be ascertained with exactness, but the actual exposure for any proportion of the entire flow can also be found."

With the machine under investigation the results of tests showed that some of the milk passed through in 15 seconds and some in 45 seconds, but that most of the milk remained in the machine about 30 seconds. When the rate of flow was diminished about one-half, the minimum period of exposure was from 25 to 28 seconds and the maximum from 70 to 100 seconds.

Bacteriological examinations were made of the raw milk and the milk after heating, after cooling with water, and after cooling with ice water. The rate of flow approximated 1,800 lbs. per hour and the rate of exposure ranged from 15 to 50 seconds. From the results of tests made under both winter and summer conditions it is considered apparent that the number of bacteria capable

of resisting the heating process is subject to wide fluctuations. This is considered due to the wide variation in time to which the milk was exposed. When the temperature fell below 150° F., the bacterial content was very greatly increased. On the whole, the results showed a much higher bacterial content than that found in milk treated with the intermittent method. It is believed that if a temperature of not less than 160° F. is maintained the bacterial content of the milk will be fairly satisfactory, although not so low as when a longer application is made at a low temperature.

Bacteriological test of a bottle-washing device, H. L. Russell and C. Hoffmann (*Wisconsin Sta. Rpt. 1905, pp. 227–231, fig. 1*).—The efficiency of a combined bottle-washing and sterilizing machine was investigated. The apparatus in question was capable of washing from 2,400 to 4,000 bottles per hour. The cleaning was considered surprisingly well done and sterilization was considered a valuable adjunct to the washing. When exposed to steam for 14 seconds the bacterial content of the bottles was found to be 268,140 bacteria per bottle and when exposed for 30 seconds, 13,740. Even when exposed for 30 seconds the bottles were by no means rendered sterile.

Bottles handled in an ordinary commercial way and exposed to steam for 10 minutes were found to contain a much smaller number of bacteria. In the condensation water in bottles which had been steamed and allowed to stand at room temperatures for 24 hours the number of bacteria varied from 1,786,800 to 3,981,000. In 2 corresponding series of bottles containing no condensation water the numbers of bacteria were 60,710 and 330,100. In a series of steamed bottles exposed to the air for 24 hours the number of bacteria averaged 292,450 per bottle, while in a similar series which had been covered with a linen cloth the number of bacteria averaged 11,615, showing the importance of keeping bottles covered.

The milk of sheep in Corsica, Comte (*Jour. Pharm. et Chim., 6. ser., 24 (1906), No. 5, pp. 199–204*).—Analyses were made of the milk of 14 flocks of sheep aggregating 1,917 individuals. The results are interpreted as showing a superior quality of the milk for cheese making as compared with that of sheep in the region of Roquefort.

Gathered-cream plants, J. Michels (*South Carolina Sta. Bul. 118, pp. 12, dgm. 1*).—The author believes that dairy farming should be encouraged in South Carolina, and in this bulletin comments on the value of cream plants to farmers making dairying a secondary matter, outlines a method of organizing a cooperative creamery, and gives general plans for the construction and operation of the plant with an itemized statement of the equipment necessary.

The relation of lactic-acid bacteria to the formation of butter flavor in milk serum, J. Michels (*Wisconsin Sta. Rpt. 1905, pp. 198–206, fig. 1*).—In the experiments reported butter made in the ordinary way was compared with butter made by the Le Clair method, in which a large quantity of ripened skim milk is added to sweet cream and the mixture churned immediately. Data were obtained as regards the flavor of the 2 kinds of butter, the bacterial content, and the keeping quality. The author's conclusions are as follows:

"From the foregoing data it is apparent that the development of the desirable flavors in butter may be made independent of the butter fat in the cream, that the growth of the lactic-acid bacteria in the milk serum results in the formation of by-products which are readily absorbed by the butter fat when brought in contact with the same and give the characteristic flavor to the butter. This would seem to indicate that the fat itself does not enter into the process, except in a passive way. It does not seem to make any particular difference, so far as the degree or intensity of the flavor is concerned, whether it develops in

direct contact with the fat, or whether it is formed independently of it and is later absorbed.

"The germ content of butter made from cream to which a ripened skim-milk starter has been added was generally considerably less than that of butter made in the usual way. This marked variation in germ content does not apparently harmonize with the uniformity of flavor noted in the 2 processes, but this seeming discrepancy is capable of ready explanation. Where the ripening changes occur in the skim milk itself, germ growth goes on to such a point that a great many of the bacteria die, leaving their characteristic by-products in the milk serum. Where the ripening occurs in contact with the cream, excessive acidity is not produced, and therefore a larger germ content is actually found, although perhaps the degree of flavor is not any more marked."

The influence of changes of temperature on the results obtained with a lactometer in calculating milk solids, P. C. RANNEY (*Wisconsin Sta. Rpt. 1905, pp. 190–197*).—In correcting lactometer readings for temperature it is quite customary to add 0.1 for each degree above 60° F. and subtract 0.1 for each degree below 60°.

The experimental work reported indicates that this method is reasonably accurate when limited to temperatures between 50 and 70°. For correcting readings taken at temperatures above 70° the addition of 0.2 for each degree was found to give closer results than the addition of 0.1.

In calculating total solids by the Babcock formula it is believed that corrections for temperature should be made by Fleischmann's or Vieth's tables, which, however, are not considered as giving accurate results for readings taken at temperatures above 80°. In order to eliminate all errors, the author concludes from the results of his experiments that lactometer readings should be taken at 60°.

Estimating the amount of water in butter by the overrun obtained in each churning, O. UEHLING and A. WALLIN (*Wisconsin Sta. Rpt. 1905, pp. 186–189*).—In the experiments the results of which are given in this article the water content of butter was determined in most instances by chemical analysis, but was estimated in some trials by the amount of overrun.

The authors conclude that the water content of butter is increased by working immediately after washing as compared with working after the butter has drained for about half an hour, and that the water content is also increased by allowing the granular butter to remain in water for some time before working. The water content of the butter was not always increased by increasing the amount of churning in the wash water nor by washing in warm water.

Renovated butter: Its origin and history, L. WELLS (*U. S. Dept. Agr. Yearbook 1905, pp. 393–398*).—This is a brief account of renovated butter. At the present time there are 78 factories manufacturing this product. During the fiscal year 1905 the output of these factories amounted to 60,000,000 lbs.

Paraffining cheese, L. F. ROSENGREN (*Nord. Mejeri Tidn., 21 (1906), Nos. 26, pp. 352, 353; 27, pp. 365, 366, figs. 3*).—Experiments with paraffining different kinds of full-cream and half-skim Swedish cheese showed losses in weight during 3 to 7 months' storage of 4.7 to 11.2 per cent.—F. W. WOLL.

The Swiss cheese industry of Wisconsin; whey butter making, E. H. FARRINGTON (*Wisconsin Sta. Rpt. 1905, pp. 157–180, figs. 12*).—This is a briefer account of observations published in Bulletin 132 of the station (E. S. R., 17, p. 1186).

Lactose-fermenting yeasts, the cause of an abnormal fermentation in Swiss cheese, E. G. HASTINGS (*Wisconsin Sta. Rpt. 1905, pp. 207–221, figs. 6*).—This is a more technical account of investigations previously reported in bulletin form (E. S. R., 17, p. 498).

Compilation of analyses of fodder articles and dairy products, made at Amherst, Mass., 1868–1905, E. B. HOLLAND and P. H. SMITH (*Massachusetts Sta. Rpt. 1905, pp. 200–223*).—These tables show the composition, digestibility, and fertilizer ingredients of various products.

VETERINARY MEDICINE.

Characteristics of some of the contagious and infectious stock diseases, A. W. BITTING and G. H. ROBERTS (*Indiana Sta. Bul. 113, pp. 209–288, figs. 20*).—The purpose of the present bulletin is to present an outline of the chief symptoms and post-mortem lesions observed in the common diseases of live stock. The most approved lines of treatment in the case of each disease are given, and mention is also made of State and Federal laws relating to these diseases.

How parasites are transmitted, B. H. RANSOM (*U. S. Dept. Agr. Yearbook 1905, pp. 139–166, figs. 50*).—The parasites referred to in this article are grouped into arthropods, roundworms, tapeworms, flukes, and protozoa. Examples are given of these various classes of parasites, with notes on their life history and the means by which they are transmitted from one animal to another.

The transmission of tuberculosis from man to cattle, A. EBER (*Berlin. Tierärztl. Wchnschr., 1906, No. 28, pp. 527–537*).—A critical review is given of the literature relating to this highly controversial problem. The author examined carefully the evidence presented by Koch for his belief in the nonidentity of human and bovine tuberculosis. The experiments carried out by the German Imperial Health Office are believed not to support the contentions of Koch.

Human tuberculosis cultivated in vivo in domestic animals, G. MOUSSU (*Compt. Rend. Soc. Biol. [Paris], 61 (1906), No. 26, pp. 95–97*).—When cultures of human tubercle bacilli were suspended in the intestinal cavity of cattle and other animals it was found that these animals would soon give a reaction to tuberculin, which existed for a year or more, although no true infection took place.

Milk and dairy products as sources of infection in tuberculosis, O. MÜLLER (*Jour. Compar. Path. and Ther., 19 (1906), No. 1, pp. 19–33*).—As a result of a study of the literature of this subject, together with personal observations and experiments, the author believes that the infectiousness of milk is chiefly referable to tuberculosis of the udder and that cows in which the udder is not affected do not excrete tubercle bacilli or at least only to a very slight extent. The transmission of tuberculosis, therefore, takes place through the milk of cows affected with the mammary form of the disease. In cases, however, in which the disease has reached an advanced stage without affecting the udder, tubercle bacilli may be found in the milk. The disease prevails especially in dairy regions among calves and pigs, and in order to avoid danger from its further dissemination it is necessary to observe great cleanliness about the dairy and sterilize all milk of tuberculous cows before feeding to calves or pigs.

The milk of tuberculous cows, G. MOUSSU (*Arch. Wiss. u. Prakt. Tierheilk., 32 (1906), No. 3, pp. 279–294, pls. 2*).—In this article particular attention was given to the study of the origin of tuberculous mammitis. The literature relating to this subject is briefly reviewed and notes are given on the pathological changes produced in the udder after tuberculous infection.

As a result of the author's investigations it is concluded that the milk of all tuberculous cows should be excluded from utilization without previous treatment. This is considered necessary on account of the fact that mammary tuberculosis can not be recognized or diagnosed in its early stages. Apparently the disease assumes such similar forms and such a similar course in both man

and cattle that the results obtained in the study of one species may be applied to the other.

Tuberculosis among dairy cows, W. L. LITTLE (*Jour. Compar. Path. and Ther., 19 (1906), No. 1, pp. 48–50*).—Circumstances are related with regard to the unusual prevalence of tuberculosis in a herd of 30 cows the owner of which appeared to take great pains in caring for and feeding animals and in keeping the stables and cows in a cleanly condition. The cows were fed a generous and suitable ration, the stables were well built, with good drainage and concrete floors, and sand bedding was used and changed daily. Good ventilation was also provided. Nevertheless the disease prevailed to such an extent that the owner felt compelled to go out of the business. The prevalence of the disease is supposed to have been due to the fact that the cows were kept confined for about 6 months of the year and that the calves were allowed to suck the cows without regard to whether they were tuberculous or not.

The spread of tuberculosis by means of male animals from the standpoint of the breeder, RICHTER (*Berlin. Tierärztl. Wchnschr., 1906, No. 10, pp. 169–173*).—It is frequently asserted that tuberculosis may be transmitted by male animals to offspring directly, through the agency of the mother animal or by means of a susceptibility to tuberculosis. The literature relating to this subject is critically reviewed.

The author concludes that male animals are not capable of transmitting tuberculosis to offspring except possibly in an indirect manner by first infecting the mother animal. The hereditary transmission of the tendency to tuberculosis is considered as of very rare occurrence.

Pleural and peritoneal tuberculosis in cattle, J. F. HEYMANS (*Arch. Internat. Pharmacod. et Thér., 14 (1905), No. 5–6, pp. 375–387, pl. 1*).—One of the most important features in the study of tuberculosis is the determination of the character and growth of tubercles found in cases of this disease. The author gave particular attention to the tubercles found on the pleura and peritoneum of cattle. These tubercles were studied not only to determine their microscopic character but also their virulence.

It appears from this study that a considerable portion of the pathological alterations on the serous membranes in the cases of bovine tuberculosis are not tubercles, or agglomerations of more or less detached tubercles, but simply inflammatory conditions which are at first progressive and later regressive. These inflammatory areas are due to irritating substances which come from neighboring tubercles. The virulence of the true tubercles is also found to vary greatly. In many cases it was impossible to obtain any virulent tubercle bacilli from them.

Failures in the tuberculin test on cattle, A. CARINI (*Arch. Wiss. u. Prakt. Tierheilk., 32 (1906), No. 6, pp. 562–573*).—The special purpose of this article is to present a summary of the author's investigations regarding the reliability of the tuberculin test. As a result of numerous experiments the author comes to the conclusion that the percentage of failure in tuberculin tests is estimated too low by most writers on this subject. According to the author's experience failure may be expected in about 17 per cent of cases, even where the greatest care and precaution are exercised.

Vaccination against tuberculosis of young ruminants in the alimentary tract, A. ARLOING (*Compt. Rend. Acad. Sci. [Paris], 142 (1906), No. 26, pp. 1487–1489*).—As a result of investigation along this line the author comes to the conclusion that an active immunity toward tuberculosis may be produced in young ruminants by feeding them cultures of either human or bovine tubercle bacilli after these organisms have been properly attenuated. There appears to

be little choice in this regard between the human and bovine bacilli. A reaction to tuberculin takes place before any infection has occurred, therefore, in the absence of all tuberculous lesions.

The effects of tuberculin absorbed by the digestive tract in healthy and tuberculous animals, A. CALMETTE and M. BRETON (*Compt. Rend. Acad. Sci. [Paris], 142 (1906), No. 11, pp. 616–618*).—The author's experiments were carried out on guinea pigs, for the reason that these animals are particularly susceptible to tuberculosis.

It was found that tuberculin absorbed by the alimentary tract has a toxic effect upon nontuberculous animals and that this toxicity is particularly manifest in young animals. There appears to be no tendency toward the establishment of a tolerance for the ingestion of the gradually increasing doses of tuberculin. If guinea pigs are rendered tuberculous by a single alimentary infection they react regularly to tuberculin if they are fed this reagent in doses of 1 mg. which are entirely without effect upon healthy guinea pigs. It was also shown by the experiments in question that in the case of tuberculous animals a reaction takes place to tuberculin whether this reagent is administered hypodermically or by way of the alimentary tract.

Griserin as a treatment of tuberculosis, SPRINGEFELDT (*Arch. Wiss. u. Prakt. Tierheilk., 32 (1906), No. 6, pp. 545–561*).—Griserin has been proposed by certain German investigators as a chemical cure for tuberculosis in human beings and animals.

The author tested this chemical on 24 guinea pigs, which were artificially inoculated with tuberculosis and afterwards treated with griserin. In no case was the disease checked by the treatment with griserin. The lesions spread and the disease showed a tendency to become generalized as rapidly as where no treatment was applied.

The action of essence of turpentine upon the virus of glanders, tuberculosis, and anthrax, V. GALTIER (*Jour. Méd. Vét. et Zootech., 57 (1906), Mar., pp. 140–147*).—It has long been known that the virus of glanders is quite easily affected by the essence of turpentine. The tubercle and anthrax bacilli, however, are far less susceptible. According to some experiments the tubercle bacillus is not destroyed by immersion for 8 hours in essence of turpentine. It would appear, therefore, that this substance is not suitable for disinfecting objects which have become contaminated with the tubercle bacillus.

Turpentine is also of little avail in destroying anthrax infection, particularly if spores are present. Experiments were carried on by the author in inoculating guinea pigs and rabbits with anthrax virus followed by vaccination with 0.25 cc. of essence of turpentine. The turpentine appeared in all cases to prolong life somewhat, and in a few instances the animals recovered entirely from a fatal dose.

The effect of preparations from tubercle bacilli upon the tuberculous organism, A. WASSERMANN and C. BROOK (*Deut. Med. Wchnschr., 32 (1906), No. 12, pp. 450–454*).—In the experiments reported in this article the authors gave attention chiefly to establishing the location of antituberculin and tuberculin in the organism of the affected animal and the reaction between these two substances.

It appears that antituberculin may be quite readily demonstrated in the tuberculous organs of man, guinea pigs, cattle, and other animals. During the treatment of tuberculous animals from preparations of tubercle bacilli a specific antituberculin appears in the general blood circulation. While the antituberculin is present in tuberculous organs of tuberculous animals it does not appear in the serum. If such animals are treated with tuberculin or other preparations from tubercle bacilli these materials, on account of their affinity

for antituberculin, pass into the tuberculous organ and become combined with the antituberculin. The specific reaction of tuberculous tissue, therefore, takes place on account of the fact that the tuberculin is attracted by the antituberculin into the tuberculous tissue and becomes localized in such structures.

The virulence of tubercle bacilli, A. MARMOREK (*Berlin. Klin. Wchnschr., 43 (1906), No. 11, pp. 328, 329*).—One of the difficulties always incurred in work with tubercle bacilli is found in determining their virulence. The author attempted to work out an original method of securing evidence of slight variation in the virulence of different cultures of tubercle bacilli. For this purpose white mice were selected and on account of their high resistance to the tubercle bacillus were previously treated with injections of quinin chlorate. This drug has the effect of paralyzing the white blood corpuscles so that the organism was less resistant to infection. During these experiments it was found that the virulence of tubercle bacilli depends primarily upon the age of the culture and grows less as the culture becomes older.

The resistance of tubercle bacilli to acid, C. CIACCIO (*Compt. Rend. Soc. Biol. [Paris], 60 (1906), No. 12, pp. 585, 586*).—It is frequently stated that the acid resistance of the tubercle bacillus is due to the presence of a fatty acid in the body of the bacillus. According to the author's investigations, however, while the tubercle bacillus does contain fatty substances the specific coloration of the bacillus and its acid resistance is not due to fatty acids, but to some other substance.

The homogenization of acid-resistant bacilli, L. KARWACKI (*Ztschr. Tuberkulose, 9 (1906), No. 3, pp. 226–228*).—In homogenizing tubercle bacilli of various sources, the best results are obtained when potatoes and diluted serum are used in the place of glycerinated bouillon. Homogeneous cultures of tubercle bacilli when transferred from one serum medium to another have a tendency to develop flocculent deposits. The bovine tubercle bacillus appears to be quite difficult to homogenize and this may be taken as a rather constant characteristic of the bacillus.

Anthrax, B. V. FURSENKO (*Arch. Vet. Nauk [St. Petersb.], 36 (1906), No. 6, pp. 393–402, fig. 1*).—A study was made of the behavior of anthrax in pure cultures and of the progress of the disease after the inoculation of rabbits, particular attention being given to the localization of the bacilli in affected animals.

Actinomycosis or lumpy jaw, D. E. SALMON and T. SMITH (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 96, pp. 10*).—This is a reprint, with a slight revision, from the Special Report on the Diseases of Cattle (E. S. R., 16, p. 708).

False foot-and-mouth disease, M. MÜLLER (*Deut. Tierärztl. Wchnschr., 14 (1906), No. 28, pp. 334, 335*).—The author observed several cases of mouth disease in cattle. The symptoms to be seen in the mucous membrane of the mouth resembled somewhat those of true foot-and-mouth disease, but were found to be due to the spines of *Ononis spinosa* which occurred in considerable quantity in the hay fed to the cattle.

Calf scours: A new method of treatment, L. A. KLEIN (*South Carolina Sta. Bul. 122, pp. 9*).—On account of the general importance and prevalence of scours among calves fed on skim milk, the author tested the value of formalin added to the milk before feeding to the calves.

In these experiments 12 calves were treated by adding formalin to the milk at the rate of 1 part to 4,000. Eleven calves recovered without any further treatment—7 on the second day, 3 on the third, and 1 on the ninth. In one case it was found necessary to administer castor oil, creolin, and subnitrate of bismuth before a complete recovery was brought about. In 3 cases of scours in calves running at pasture and receiving grain at the same time the formalin treatment did not prove effective.

Foot-rot of sheep, J. R. MOHLER and H. J. WASHBURN (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 94, pp. 117–137, fig. 1*).—This circular is reprinted from the annual report of the Bureau for 1904 (E. S. R., 17, p. 715).

The parasite of common sheep scab, C. M. JOHNSTON (*Orange River Colony Dept. Agr., Biol. Div. Leaflet 2, pp. 6, figs. 4*).—Distinction is made between common scab, head scab, and foot scab as affecting sheep. The common scab mite is described and notes are given on its life history.

According to the present law in the Orange River Colony the second dipping of sheep is required to be given 14 to 18 days after the first. It is proposed to change this so as to require that it be done within 10 to 14 days.

A clinical study of braxy, R. FROEHNER (*Deut. Tierärztl. Wchnschr., 14 (1906), No. 30, pp. 359, 360*).—Occasion was offered for a study of a number of cases of this disease in sheep. The feed which the sheep received was examined and found to be in good condition. It was therefore not concerned in the production of the disease.

According to the evidence obtained it appears that the sheep became infected during the process of shearing as the result of using uncleanly shears. A bacteriological examination showed the presence of the bacillus of malignant œdema.

Bursattee, F. E. PLACE (*Vet. Rec., 18 (1906), No. 923, p. 646*).—It has been found that iodized phenol is an excellent remedy for this disease. Experiments indicate that iodin is the most certain agent for destroying nematode worms in the blood and feces of infected animals.

Copper salts as a supposed preventive of hog cholera, S. AVERY (*Nebraska Sta. Rpt. 1905, pp. 116, 117*).—Hogs were fed a solution of copper sulphate at the rate of 1 lb. per gallon of water, with or without Rochelle salts, to render the solution alkaline. Since the hogs seemed to endure the solution without Rochelle salts, as well as when this chemical was added, the plain copper sulphate solution was used at the rate of 1 oz. per day for each hog. This treatment continued for several weeks and caused no trouble except an occasional loss of appetite. A test was then made to determine whether the solution of copper sulphate was of any value in preventing infection of hog cholera. It was found in this experiment that hogs treated with copper sulphate became affected and died in the same manner as those which were not treated.

Hog cholera, F. KOSKE (*Arb. K. Gsndhtsamt., 24 (1906), No. 2, pp. 305–345*).—As a result of numerous cultures and observations on *Bacillus suipestifer*, the author determined that the hog cholera bacillus may retain its virulence perfectly for 2 or 3 months in ordinary agar cultures or for 120 to 160 days in the buried carcasses of pigs.

The cultures were destroyed by subjection to a 2½ per cent cresol solution for 1½ minutes or a 5 per cent carbolic solution for 3 minutes. Numerous experiments were made in testing the susceptibility of various laboratory animals and larger domestic animals to the organism of hog cholera, and notes are given on the pathological condition produced by such inoculation. In the author's experience there is little difference in the agglutination results as obtained by the use of a monovalent and polyvalent serum. Serum obtained from an inoculated ass was able to protect hogs against fatal doses of hog cholera bacilli previously inoculated intravenously.

The etiology of hog cholera and swine plague, F. HUTYRA (*Berlin. Tierärztl. Wchnschr., 1906, No. 32, pp. 607–610, figs. 5*).—The literature relating to the controverted points regarding hog cholera and swine plague is briefly reviewed.

In experiments carried out by the author it was found that a filtered blood serum or fluid from the lungs of hogs affected with acute swine plague was capable of producing an acute infectious disease after subcutaneous inoculation

in young pigs. In some cases such inoculation produced a rapidly fatal hemorrhagic septicemia. The author believes that there is some evidence in favor of assuming the existence of an ultramicroscopic organism as the cause of swine plague.

Hog cholera and swine plague in South Africa, A. THEILER (*Fortschr. Vet. Hyg., 4 (1906), No. 6, pp. 121–128*).—As the result of a long-continued study of these diseases in South Africa, the author concludes that *Bacillus suisepticus* as it occurs in South Africa is practically identical with the usual form observed in Europe. The pathological lesions produced in South Africa are also the same as those described by European investigators.

The author produced an infection in 4 out of 7 hogs which were fed large quantities of the bacteria, and suggests that the large percentage of infection may have been due to the presence of intestinal worms. In nearly all cases hog cholera is associated with swine plague in South Africa. In fact, the author never observed but one case of swine plague in which *B. suisepticus* was demonstrated and in which hog cholera was not present. Apparently there is no epizootic in South Africa due to *B. suisepticus*, but the common infectious hog disease is associated with hog cholera, which gives *B. suisepticus* an opportunity to infect hogs.

Is the virus of swine plague and hog cholera filterable? R. OSTERTAG (*Berlin. Tierärztl. Wchnschr., 1906, No. 34, pp. 623–626*).—In experiments in the filtration of the virus of swine plague the results were negative in some cases and positive in others. Where positive results in infection took place it appeared that the infection was due to some other agent than the organism of swine plague.

The author also carried on some experiments in filtering the virus of hog cholera to determine whether this virus was infectious as shown to be in some cases by the Bureau of Animal Industry of this Department. In the first test the filtered virus was not infectious, but when material from this country was used in the experiments it was found to be virulent after filtration. The author expects within the near future to develop a practical system by means of which hog cholera may be controlled.

The relation of Bacillus pyogenes suis to swine plague, F. KOSKE (*Arb. K. Gsndhtsamt., 24 (1906), No. 2, pp. 181–195*).—Numerous investigators have attempted to determine the exact relationship of *B. pyogenes suis* to swine plague. The literature relating to this subject was briefly reviewed by the author. The organism in question was cultivated on a number of nutrient media and notes are given on the behavior of the bacillus. The organism is killed by subjection to a temperature of 55° C. for 20 minutes or by treatment with a 1 per cent corrosive sublimate solution for 1 minute, a 3 per cent cresol solution for 1 minute, or a 5 per cent carbolic acid solution for $1\frac{1}{2}$ minutes.

Inoculation experiments were made on laboratory animals and pigs, the bacterial cultures being injected into the blood, lungs, body cavity, and musculature, or being given in feeding experiments and by inhalation. Any of these methods of inoculation may cause the death of some of the experimental animals under symptoms of acute septicemia, but in most cases there is only a local abscess formation. In no case was there a development of the usual symptoms of swine plague in the lungs. Accordingly the author concludes that *B. pyogenes suis* may cause general septicema or pyemia or local abscesses, but is not the true cause of swine plague.

Toxic phenomena observed as a result of injecting dead glanders bacilli into the stomach, J. CANTACUZÈNE and P. RIEGLER (*Compt. Rend. Soc. Biol. [Paris], 61 (1906), No. 27, pp. 231–233*).—The experiments reported in this paper were carried out on guinea pigs, both young and adult. It was found that

when large quantities of dead glanders bacilli were injected into the stomach of guinea pigs they produced more or less severe intoxication followed by a rapid death in cases where large numbers of the bacilli were used. Not only the soluble products of the bacilli but the bacterial bodies themselves pass through the intestinal wall and are found in the ganglia, spleen, and lungs, where they may produce broncho-pneumonia. Where small quantities of the dead bacilli are used a tolerance is developed on the part of the animal, which may last for a period of 3 months.

A disease of the horse simulating farcy, F. S. H. Baldrey and G. D. Martin (*Jour. Trop. Vet. Sci., 1 (1906), No. 3, pp. 316–319*).—In a case which closely resembled farcy an organism was obtained which is somewhat shorter and thicker than that of the glanders bacillus. Inoculation of guinea pigs with this organism produced a mild illness which lasted for 4 or 5 days, but the lesions were not fatal. The period of incubation was 4 days.

An anthrax-like bacillus found in a horse suspected of anthrax, R. E. Montgomery (*Jour. Trop. Vet. Sci., 1 (1906), No. 3, pp. 284–294*).—In a suspected case of anthrax it was found impossible to obtain cultures of the true anthrax bacillus. The symptoms and lesions were apparently those of anthrax. Notes are given on the behavior of the organism on various cultural media. From inoculation experiments it was found possible to obtain pure cultures of the organism which did not produce serious disease in most cases. The exact relationship of the organism is not known.

Experimental nagana, A. Rodet and G. Vallet (*Compt. Rend. Acad. Sci. [Paris], 143 (1906), No. 6, pp. 327, 328*).—In previous experiments the authors have tested the effect of injections of the spleen of dogs into rats artificially inoculated with nagana.

Attention is called to the fact that a sudden reduction in the number of blood parasites may take place under other conditions in which the action of the spleen is excluded. It is necessary, therefore, to be rather cautious in drawing conclusions as to the effect of inoculations of spleen. The authors are disposed to ascribe the sudden disappearance of the blood parasites in the dog to a crisis in the disease during which the trypanosomes are destroyed by the action of a specific property of the blood.

Trypanosoma brucei and experimental nagana, A. Rodet and G. Vallet (*Compt. Rend. Soc. Biol. [Paris], 61 (1906), No. 27, pp. 186–189*).—As the result of an extended study of the blood parasites of nagana in rats and dogs, the authors conclude that some of the abnormal forms occasionally called ameboid are not regular stages in the development of the parasite, but are the result of abnormal stimulation of these organisms.

The parasites multiply rapidly in the blood, in especially large numbers in the capillaries of the liver. The blood parasites are also rapidly destroyed in the infected animal, and in this destruction certain organs are especially active, the spleen being most so and the liver least. The trypanosomes, however, may degenerate and die in the circulating blood. In most cases where secondary bacterial infection took place in the experimental animals the number of trypanosomes at the time of death was very small.

Souma, L. Cazalbou (*Rev. Gén. Méd. Vét., 8 (1906), No. 89–90, pp. 240–248*).—In the French Soudan a trypanosomiasis prevails among horses and cattle and is commonly referred to under the name souma. It has affected a large number of animals during the past 3 years, attacking 14 per cent of horses and cattle in certain localities. There appears to be some difference in the susceptibility of different breeds of cattle. Zebus are even more susceptible than common cattle. Notes are given on the symptoms and etiology of the disease. It appears to be carried by certain species of Tabanus.

Trypanosomiases of Barbary in 1905, Edmond and Étienne Sergent (*Ann. Inst. Pasteur, 20 (1906), No. 8, pp. 665–681*).—A brief review is presented showing the distribution of various forms of trypanosomiasis in different parts of Barbary. It appears that about 9 per cent of dromedaries are infected and 0.17 per cent of horses.

Experiments in testing the virus of different forms of trypanosomiasis on rats and other experimental animals showed that the trypanosomes of the disease known as debab are not ordinarily carried by horse flies and are not capable of penetrating through healthy mucous membranes, as is the case with the trypanosome of dourine. The authors believe, therefore, in the existence of two distinct forms of trypanosomiases in Barbary.

Congestive and hemorrhagic forms of pasteurellosis in the horse, Fairise (*Rev. Gén. Méd. Vét., 8 (1906), No. 89–90, pp. 225–240*).—In the early stages of pasteurellosis in horses an acute congestive condition is frequently observed, but such congestion is ordinarily secondary to pulmonary lesions. In cases where serious hemorrhagic conditions prevail it is necessary to administer hemostatic drugs and also to reduce the temperature. Most of the drugs which might be thought of in this connection have certain disadvantages for the reason that they produce depression. Among these mention is made of acetanilid and quinin. The best results were obtained from the use of chlorid of lime and gelatin.

Experiments with Lorenz' organism of pneumonia, Schweikert (*Berlin. Tierärztl. Wchnschr., 1906, No. 30, pp. 567, 568*).—A small piece of skin was removed from a horse affected with pneumonia, and from this material the organism of the disease was obtained in pure cultures. When used in inoculating a colt it produced the regular symptoms of the disease on the following day. Another colt exposed to natural infection also showed the usual symptoms, but recovered.

The etiology of pleuro-pulmonitis of horses, L. Baruchello and A. Pricolo (*Clin. Vet. [Milan], 29 (1906), No. 29, pp. 697–700*).—The authors were unable to isolate any bacterial organism which could be considered as the cause of this disease. In the blood and spleen, however, certain corpuscles were observed which appeared to be of a protozoan nature and which may be concerned.

Feeding wild plants to sheep, S. B. Nelson (*Washington Sta. Bul. 73, pp. 64, figs. 40*).—Botanical descriptions and illustrations are given on 40 plants which occur on sheep ranges, which were considered worthy of investigation to determine their harmful and harmless character. Notes are given on losses which have occurred on sheep from time to time and which have generally been attributed to the action of poisonous plants. The flora of one region noted for the occurrence of poisoning contained 55 different plants, the most of which were gathered in a fresh condition and fed to sheep.

As a result of these experiments it appeared that *Zygadenus venenosus* may cause poisoning, but that *Delphinium menziesii* is not poisonous in any stage of growth. Among the lupines studied only *Lupinus ornatus* appeared to be poisonous. Neither arnica, wild cherry, nor any of the other plants studied caused symptoms of poisoning.

Poisoning of horses by the common horsetail weed (Equisetum arvense), A. T. Peters and L. B. Sturdevant (*Nebraska Sta. Rpt. 1905, pp. 111–115, pl. 1*).—On account of complaints of the poisoning of horses from eating common horsetail an examination was made of this plant and feeding experiments were carried out. In one case a mare was fed 46 lbs. of horsetail hay during a period of 3 weeks without showing any characteristic symptoms of poisoning. In all of the experiments the horses showed a distinct aversion to the weed.

The amount fed ranged from ½ lb. per day, at the start, to 6 lbs. The first symptoms of poisoning in one case began on the fourteenth day and consisted of a crouching gait, partial loss of muscular control, pale bluish color of the mucuous membranes, and occasionally a subnormal temperature. The symptoms of staggering were most apparent on cold, rainy days. Decoctions of horsetail were also made and given to horses.

The authors conclude from their experiment that horsetail is not present in the hay of Nebraska in sufficient quantities to be dangerous to horses, but that in large amounts this weed might prove fatal.

Occurrence of barium in the Ohio Valley brines and its relation to stock poisoning, C. D. HOWARD (*West Virginia Sta. Bul. 103, pp. 281–295*).—From time to time reports have been given of farm animals dying under symptoms of poisoning without the cause being definitely determined, but the suspicion pointing to the salt used in each case.

An analysis of samples of brine obtained from the Ohio Valley of West Virginia showed the presence of barium chlorid in quantities ranging from 21 to 46 grains per gallon of brine. The barium chlorid is a highly poisonous drug causing a great increase of blood pressure and other effects similar to those of digitalis. The symptoms of poisoning resemble those of nitrate of potash, but the barium chlorid is much more poisonous. If the brine is treated with sodium sulphate or soda ash the barium, lime, and magnesium contained in the brine will be removed and the salt obtained from it will be of better quality for general use.

Brief notes are given on the character of the salt obtained in West Virginia and on the antiseptic properties of chlorid of lime and barium.

RURAL ENGINEERING.

First annual convention of the North Dakota drainage league: The International drainage conference (*Grand Forks, N. Dak.: Press Pub. Co., 1906, pp. 89*).—The report of the North Dakota Drainage League contains an address by Hon. J. L. Cashel suggesting the desirability of including drainage projects under the provisions of the National Reclamation Law; an address by G. A. Ralph in which he discusses drainage projects completed or under construction in Minnesota; a paper on the relation of the office of State engineer to drainage problems, by A. L. Fellows; an address by C. G. Elliott in which he treats of the need and value of drainage, its results in other localities, and its legal phases, particularly with reference to assessment for the expenses of drainage improvements and the avoidance of unnecessary litigation; and a paper by J. T. Stewart on the drainage problems of the Red River Valley as related to the Dakota side, in which the more technical phases of the question are discussed, with an outline of a scheme of drainage to give the best service at the least cost. Papers and addresses were delivered at the International Drainage Conference by Hon. J. L. Cashel, Prof. E. F. Chandler, Prof. W. R. Hoag, C. H. Dancer, of Manitoba, and G. A. Ralph.

Subsurface drainage of land by tile, R. E. HORTON (*Reprinted from Mich. Engin., 1906, pp. 22, figs. 8*).—This is an attempt to place upon a mathematical basis the determination of the amount of water removable by tile drains in a given time, their distance, and size. The treatise is based upon formulæ derived by Slichter for the flow of water through soils, which the author has adapted to the present purpose. These formulæ involve constants depending upon the porosity of the soil and the effective diameter of the soil grains. In order to make the formulæ applicable, the constants are given for a number of cases. The results of typical problems seem to check with successful prac-

tice, thus apparently conforming the author's idea that the problems connected with land drainage can be placed upon a fairly rational basis.

Drainage of tidal and swamp lands in South Carolina (*Engin. News, 56 (1906), No. 8, p. 194*).—This is a report of the drainage convention held in South Carolina, at which a paper was presented by Dr. E. Mead and C. G. Elliott, summarizing the results secured by this Office in its studies in South Carolina.

"It appears from facts given in the paper that large areas of rice lands, some of which have been in cultivation for a century or more, have been and others must be abandoned, or at least other crops substituted for rice; this is largely due to changes in river conditions, including lack of fresh water required for flooding the rice fields."

Three conditions are necessary to make the land suitable for cultivation:

(1) Strengthen the existing levees, rebuild those destroyed, and make them high enough to withstand floods.

(2) Ditch the inclosed lands, so that soil water can be removed to a depth of 3 ft.

(3) Install pumping plants to remove all such drainage water as can not be removed by gravity through sluices or trunks.

The entire drainage problem is summarized as follows: "The coastal section of the State must be drained before it will be sufficiently healthful to attract thrifty and intelligent farmers. This can be done in such a way as to make the country sanitary, with the exception of the river lands, for \$5 per acre, and for high-class cultivation for \$10 to \$15 per acre. The tidal river rice lands which are injured by salt water should be converted into drained fields and planted in upland crops. This may be done at a cost of \$15 per acre."

The relation of irrigation to dry farming, E. Mead (*U. S. Dept. Agr. Yearbook 1905, pp. 423–438*).—In this article the author discusses the question of so utilizing lands in the great semiarid belt of this country as to make them support the largest number of people while giving them the greatest measure of human comfort. The failure and lessons resulting from the first attempts to farm these lands are reviewed and the present reawakened interest described.

In connection with dry farming the writer considers a small irrigation plant a prerequisite of success, and three methods are given by which it is deemed possible to control enough water to irrigate from 1 to 10 acres of every dry farm: (1) Pumping from soil water or underground streams; (2) storage in small surface reservoirs of storm waters or the irregular flow of streams; and (3) irrigation with flood water, usually in the winter or spring. Each of these methods is discussed and existing successful examples given.

The following principal conclusions are drawn: (1) That the foundation of the dry farm should be mixed husbandry, in which stock raising is the leading feature. (2) The dry farm should have a larger acreage than either the irrigated or humid farm, particularly if irrigation is to be a feature of the dry farm. (3) There are few localities where enough water can not be had for the irrigation of 1 to 10 acres on each section. (4) Supplemental irrigation is the insurance of the dry farm whether the water is confined to intensive cultivation of a small tract or used in emergencies on larger areas.

The State engineer and his relation to irrigation, R. P. Teele (*U. S. Dept. Agr., Office Expt. Stas. Bul. 168, pp. 99, fig. 1*).—This bulletin discusses the whole subject of public control of the use of water in irrigation, since in most of the arid States whatever there is of public control centers in the office of the State engineer. The matter is taken up by States in the order in which the office of State engineer was created.

The essential features of a system of public control of irrigation are: Some method of defining rights acquired before the assumption of control by the State; a procedure for the acquirement of rights, and an administrative system for distributing the water of streams to those entitled to its use. The laws of each State are discussed from these three standpoints. There is now fairly complete control of irrigation by the State in Wyoming, Nebraska, Idaho, Utah, Nevada, North and South Dakota, and Oklahoma, while Colorado, Montana, Oregon, and New Mexico have only partial provision for such control.

The bulletin sketches the history of irrigation legislation in each of these States and shows the efficiency of the laws enacted as demonstrated by experience.

Irrigation and the permeability of soils, A. MÜNTZ and L. FAURE (*Compt. Rend. Acad. Sci.* [*Paris*], *143* (*1906*), *No. 7, pp. 329–335; abs. in Rev. Sci.* [*Paris*], *5. ser., 6* (*1906*), *No. 8, p. 242*).—In this note the authors discuss the relatively slow development of irrigation in France.

Large enterprises backed by private capital are uniformly unsuccessful financially, due chiefly to the conservatism and ignorance of the farmers together with the change of habits and system of cultivation which the adoption of irrigated agriculture necessitates. Governmental control or aid in these enterprises is therefore recommended, and to break down the conservatism of the farmers and increase the acreage of land irrigated the authors advocate principally the division and sale of water by volume rather than by continuous flow during the season. To make it possible for the farmer to use the volume of water bought most advantageously, the writers propose a system of investigations into the permeability of soils, from which it will be possible to classify the soils with respect to their relative permeability. Experiments on the water requirements of soils of certain permeabilities are to be made, from the results of which it will be possible to predict the water requirement of soil of any degree of permeability.

The duty of well water and the cost and profit on irrigated crops in the Rio Grande Valley, J. J. VERNON, A. E. LOVETT, and J. M. SCOTT (*New Mexico Sta. Bul. 56, pp. 52, figs. 3*).—This bulletin contains the results of observations made during the seasons of 1903 and 1904 in cooperation with this Office.

Four subjects were investigated: (1) The relative value of well and river water for alfalfa; (2) the cost of growing alfalfa with well and river water; (3) the cost of growing wheat, corn, and sweet potatoes with well water; and (4) the determination of effects of temperature of irrigation water upon plant growth. From the results the following principal conclusions were drawn:

"No perceptible difference, due to a difference in the temperature of the water, was noticeable between the crops grown with well and with river water. The well water in New Mexico was 8.4° F. warmer on the average than Utah river water used for irrigation.

"The largest yield per inch of water was obtained when a depth of 24 in. was applied to wheat, and 39 in. to alfalfa, 5 cuttings of alfalfa being secured during the season.

"The results of these experiments have shown quite conclusively that the yearly profits may be considerably increased during years of shortage in the water supply by supplementing the river water with well water.

"Averaging the results obtained from crops grown with well water during the season of 1904, we have the following:

"(a) Depth of water required: Alfalfa, 36.4; wheat, 26.6; corn, 25.2; and sweet potatoes, 17.6 in.

"(b) Cost of pumping per acre: Alfalfa, $10.50; wheat, $9.80; corn, $6.92; and sweet potatoes, $4.91.

"(c) Cost of applying the water per acre: Alfalfa, $1.23; corn, 85 cts.; and sweet potatoes, 64 cts.

"(d) The yield per acre: Alfalfa, 2.33 tons; corn, 31.9 bu.; and sweet potatoes, 10,000 lbs.

"(e) The value of the crop per acre: Alfalfa, $35.03; wheat, $18.09; corn (including the stover), $36.27; and sweet potatoes, $170."

Public roads: Mileage and expenditures in 1904 (*U. S. Dept. Agr., Office Pub. Roads Circs. 39, pp. 2; 40, pp. 2; 41, pp. 3; 42, pp. 2; 43, pp. 3; 44, pp. 4; 45, pp. 4; 46, pp. 3; 48, pp. 4; 49, pp. 2; 50, pp. 2; 51 pp. 2; 52, pp. 2*).—These are a series of leaflets issued by the Office of Public Roads, U. S. Department of Agriculture, in which road statistics are given by States. The present numbers include the States of Alabama, Arizona, Arkansas, Iowa, Maine, Maryland, New Hampshire, New Mexico, North Carolina, Oregon, Tennessee, Virginia, and Washington. For each of these States statistics are given by counties as to the total number of miles of public roads, together with those which have been surfaced, and the expenditure in money and labor as property and labor tax.

An experiment in dust prevention (*Engin. Rec., 54 (1906), No. 12, p. 311*).—Experiments by the State engineer are being carried on near Troy, N. Y., on the prevention of dust on a road running through a village of considerable population, where the dust nuisance is very annoying.

The means employed are as follows: "Tar, of about the consistency of molasses when cold and fluid when heated, is sprinkled over the road surface. The low spots in the road are then filled with screenings, which are consolidated by the traffic before the second application of the tar is made. This process is repeated a third time, and is said to result in a practically dustless highway, which will not need another treatment for a year or more. The tar employed is specially prepared for the purpose by boiling until all its water has been driven off, so that it is not likely to foam when heated for application to the roads."

Tar and oil for road improvement: Report of progress of experiments at Jackson, Tenn. (*U. S. Dept. Agr., Office Pub. Roads Circ. 47, pp. 8*).—In this circular are reported results of experiments with coal tar, Texas oil and its residuums, in the improvement of macadam and earth streets and roads. The tar was applied during hot weather to the repaired, cleaned, and thoroughly dried surfaces of roads in and near the city of Jackson, Tenn. The tar was kept at a temperature of 200° while being conveyed over the roads in a tank wagon, from which it was distributed over the road surface by a hose with special nozzle and spread evenly in a thin layer by laborers using stiff brooms. The tar was absorbed by the road in 8 or 10 hours, after which a light coat of sand or screenings was evenly spread over the surface and the road rolled by steam roller. The average quantity of tar used per square yard was 0.45 gal. and labor cost $0.0056 to $0.0095 per square yard.

It is stated that "after more than 7 months, including the winter season of 1905–6, the tarred roads and streets are still in excellent condition. They are hard, smooth, and resemble asphalt except that they show a more gritty surface." By sections cut from the streets it was found that the tar formed a matrix of 1 to 2 in. in thickness, in which the individual stones were embedded. The tar is said to have antiseptic qualities, to make the road as dustless as asphalt, and to lessen greatly the noise of traffic.

In the experiments with oil on city streets, 0.48 gal. was used per square yard at a cost for labor of $0.0057 per square yard. On the county roads the respective items were 0.38 gal. and $0.0033. The oil was applied to the dusty

road surface and no subsequent treatment except spreading by brooms was given. The best results were obtained with heavier oils used hot. Dust is largely prevented on roads treated with the heavier oils, but the light, crude oil was found too volatile to produce permanent results.

The oiling and tarring of improved roads (*Engin. Rec., 54 (1906), No. 8, p. 197*).—A discussion of means for abating the dust nuisance on country roads. The inefficacy of oil treatment when the oil is merely sprinkled upon the improved road surface is well shown, it being concluded that "oil treatment is decidedly worse than nothing, especially as the result, after a period of dry weather, is no less dust than before and certainly of a not less disagreeable character." When the road surface is swept clean and is perfectly free of dust, crude oil or tar treatment is suggested, but the fact is emphasized that the road surface must be clean and dry and traffic must not be resumed until the oil or tar is absorbed. This, it is stated, will prevent the raising of dust for a considerable period.

The concrete block industry as an adjunct to agriculture, E. FREUND (*Masch. Ztg., 4 (1906), Nos. 11, pp. 124–126, figs. 2; 12, pp. 133, 134; 13, pp. 145–147, figs. 6*).—The writer describes a molding machine for the manufacture of concrete brick, and blocks for various uses; for example, cornices, lintels, arches, etc., together with a hand or power driven machine for the mixing of materials. The proportions of the various ingredients are given and also a discussion of the relative lengths of time of setting with different grades of cement. The total cost for the manufacture of 1,000 brick is given as $2.65 using lime and cement, and $3.20 using cement alone at the prices for the respective materials prevailing in Germany.

The number and distribution of silos in Wisconsin, G. N. KNAPP (*Wisconsin Sta. Rpt. 1905, pp. 363–366, fig. 1*).—A statistical record compiled from reports by assessors on the number of silos in the various counties of Wisconsin. The number of silos per county is found to be usually in direct proportion to the number of dairies. The total number reported for the State was 716.

Motor trucks and motors at the fifth automobile show, M. HARDY (*Ann. Gembloux, 16 (1906), Nos. 4, pp. 213–235, figs. 10; 6, pp. 359–385, figs. 9*).—The writer describes a large number of power trucks, giving data as to their performance and structural details. He compares gasoline and steam motors in their application to motor trucks and finds that "if one considers the progress which has been made and the advantages of steam, steam motors should be in more favor than the other. So far as starting and changes of velocity are concerned, particularly for heavy trucks, steam motors possess an elasticity and pliancy which do not belong in the same degree to the internal combustion motor."

A so-called "energy-car" is described, which is designed especially for use in agricultural operations. It consists of a light wagon carrying an explosion motor coupled to an electric generater by a special device. The generator is so wound that it may operate either as generator or motor, and it is connected to a small storage battery carried by the wagon. The batteries furnish an additional power when the load is greater than the explosion motor can develop normally. By the entire combination a flexibility of control, ease, and certainty of operation are obtained which would not be possessed by the explosion motor alone, to which are combined the advantages that it may deliver mechanical energy at the wagon or electrical energy at a distance to be used for power or electric lighting.

With reference to the economy of different types of motor, the writer regards the motors of the automobile type much less economical and durable than other types of motor due to their high velocity of rotation and greater cylinder

wear due to short length of connecting rod. They are, however, cheaper in first cost than other types. The author states that gasoline motors furnish power at 0.141 franc per 100,000 kilogrammeters (2.7 cts. per 723,240 ft. lbs.).

Accidents by farm machinery, G. N. Knapp (*Wisconsin Sta. Rpt. 1905, pp. 367–373*).—Statistics relating to the number of persons injured or maimed in the operation of farm machinery are presented.

From the figures given it is found that accidents resulting from the use of corn shredders "are in the majority of cases serious. Twenty-eight per cent are fatal, 50 per cent result in cripples by the loss of arms or hands, and 23 per cent of the accidents result in partial cripples by the loss of fingers. In 1904 16 persons lost arms in corn shredders to 10 persons who lost arms in all other machinery combined."

Attention is directed to the great care necessary in the operation of corn shredders, and the law relating to the equipment of such machinery with safety devices is given.

Alcohol in gasoline engines, E. W. Longanecker (*Farm Implements, 20 (1906), No. 6, p. 40*).—In an article originally appearing in *Gas Power* the writer gives the results of some preliminary experiments on the use of alcohol in gasoline engines. He thinks that the average compression pressure for alcohol should be somewhere between 90 and 120 lbs. per square inch, and advises increasing the length of the connecting rod or making such changes in the compression space as will bring about this pressure. It was found that while the engine could be started by the use of alcohol alone by spraying the latter into the inlet pipe, it was much more satisfactory to use gasoline for the first 12 or more impulses.

Denaturized alcohol in France (*Sci. Amer. Sup., 62 (1906), No. 1599, pp. 25613–25615, figs. 4*).—In this article the writer considers chiefly the denaturizing agents employed in France, comparing the kinds and proportions with those used in other countries.

The official denaturant in use in France at the present time consists of 1.0 part of methyl spirit (wood alcohol) and 0.5 part standard benzine to be added to every 100 parts of alcohol. The denaturants may vary under official license, with the particular use to which the product is to be put. For use in internal combustion engines, about 50 per cent of benzine is added, which increases the calorific power of the alcohol to about 7,850 calories—nearly the same value as for gasoline. The denaturants have been found unsatisfactory, especially when used in engines, and the French Government offers a prize of $4,000 for a denaturant which renders the alcohol unfit for drinking yet without objectionable odor, which will not separate by fractional distillation or erode the metal parts of lamps or motors, which will not be poisonous, but which may easily be detected. A second prize of $10,000 is offered for an apparatus which will allow alcohol to be used for lighting in the same manner as is petroleum.

The apparatus used in the denaturizing process is illustrated and described. It is said that the process is a most simple one, requiring no heating or like apparatus.

RURAL ECONOMICS.

Causes affecting farm values, G. K. Holmes (*U. S. Dept. Agr. Yearbook 1905, pp. 511–532*).—Based on inquiries addressed to 45,000 correspondents throughout the United States, the causes which have influenced the increase in value of farm lands and improvements since the census of 1900 are summarized and discussed.

This increase since 1900 is estimated at 33.5 per cent on the value of all farm property, or $6,131,000,000 for the 10 classes of farms as grouped by the Census.

"The rate of increase for cotton farms is highest, 48.2 per cent . . . and the lowest of all [are] the dairy farms, with an increase of 25.8 per cent." The most important causes assigned in explanation of this increase of farm values are the increase in prices received for farm products during the past 5 years and the pressure of new demand for land upon a fixed area. Incidentally, however, very large effects in increasing values "have been derived from better cultural methods, from the substitution of profitable for unprofitable crops, by the adoption of more intensive culture and crop, by better applied labor, by larger and cheaper facilities for reaching markets, and by some improvements in the business features of marketing products. Each one of these causes is of large account and all together combine to make the net return per acre larger than it was 5 years ago by an amount sufficient to raise the capitalization of farm lands in a considerable degree."

The influences affecting both the increase and decrease of farm real-estate values are itemized and grouped according to the economic phenomena and conditions most noticeable throughout the North Atlantic, South Atlantic, North Central, South Central, and Western groups of States. These conditions are giving rise to movements in population which tend to raise values where they are most needed, namely, in the South, in the semiarid regions of the West, and in "the depressed East." The author points out the importance of the adjustment of urban and rural populations in promoting national welfare, and concludes that "high prices of lands necessarily require that there shall not be too large a percentage of total population engaged in agriculture, and the nonagricultural population must be prosperous so as to pay profitable prices for agricultural products."

Agriculture in the United States, J. J. Macfarlane (*Com. Amer., 3 (1906), No. 1, pp. 6–8, dgms. 3*).—Statistics relating to the increased yields and values of staple agricultural products are reported and discussed, the data being compiled in great measure from the census of 1900 and from the publications of this Department for the years 1900 to 1905, inclusive. The economic factors contributing to the great development of the agricultural wealth of the United States are also enumerated.

The world's agriculture, J. J. Macfarlane (*Com. Amer., 3 (1906), No. 3, pp. 10–12, dgms. 3*).—By means of diagrams the author discusses the relative proportions of land of the world's leading nations that are devoted to cereal production, to pasture, and to forests, as well as the extent of cultivated, cultivable, and waste land in each country.

Statistics are presented of the present population of the various countries and of the world's cereal production in 1905. The average yields of leading cereals for the five years 1901–1905, expressed in millions of bushels, are as follows: Oats, 3,371; wheat, 3,160; corn, 2,896; rye, 1,581; barley, 1,330. From a study of all the data presented the author believes that no nation at present is equal to the United States in agricultural area or wealth, and that there is very little prospect of any being so in the near future.

The value relations of buildings, live stock, and implements to fixed capital, Clausen (*Jour. Landw., 54 (1906), No. 3, pp. 217–234*).—The author defines fixed or basic capital (*Grundkapital*) as the combined value of land and buildings, and discusses the value relation to each other of the different elements of capital invested in agriculture.

The Province of Schleswig-Holstein is divided into 5 groups according to certain definite characteristics of the land, and statistics are presented of each group which show the relation of cultivated area to total area; the estimated value of estates not including improvements; the percentage of investments in buildings, live stock, and implements; the value per hectare of total area in-

cluding buildings; and the value of buildings, live stock, and implements per hectare of total area and per hectare of cultivated area.

Rural credit institutions: Mutual funds, P. GILLIÉRON-DUBOUX (*Institutions rurales de crédit: les caisses mutuelles. Lausanne: P. Fatio, 1906, pp. 103*).—In this work the author treats in detail of the origin, development, and aims of agricultural credit institutions in Belgium, Germany, Italy, France, and Switzerland, with brief notes on the present status of such organizations in a few other European countries.

The history of the different forms of mutual societies for raising and advancing loans to agriculturists is considered. The aim of the author is to give to agriculturists of Switzerland, and particularly to those of the Canton de Vaud, precise information concerning the best method of organizing and dispensing agricultural credit. The methods practiced in France are regarded as giving the most favorable results.

In a series of appendixes the author gives specimen by-laws of a Raiffeisen society, of local and district mutual agricultural credit societies of France, and of a mutual rural society of the Canton de Vaud.

Crop Reporter (*U. S. Dept. Agr., Bur. Statis. Crop Reporter, 8 (1906), Nos. 3, pp. 17–24; 4, pp. 25–32; 5, pp. 33–40*).—These numbers for July, August, and September, 1906, contain in addition to the usual statistics on the condition of crops in the United States and foreign countries the following special articles: Tobacco acreage and condition July 1, 1906, by types; exports of durum wheat, 1905–6; exports of farm and forest products in 1906; adulteration of alfalfa seed; alcohol production in the German Empire; imports of farm and forest products in 1906; and other topics relating to agricultural statistics.

Agricultural statistics, 1905 (*Bd. Agr. and Fisheries [London], Agr. Statis., 1905, pp. LXI+306*).—This publication contains complete returns of acreage under crops and grass and number of live stock in each county of Great Britain for the year ended June 5, 1905.

Statistics are also given on the value of land; returns of produce and yield per acre; prices of wheat, barley, oats, bread, live stock, and other agricultural produce; trade in live stock with Ireland; supply of cattle, sheep, and pigs at certain markets; agricultural imports and exports of the United Kingdom; and on the weather of Great Britain. Indian, colonial, and foreign agricultural returns are included and compared.

Agricultural returns of Great Britain, 1906 (*Bd. Trade Jour. [London], 54 (1906), No. 510, pp. 454, 455*).—A summary is given of the acreage under crops and the number of live stock in Great Britain on June 4, 1906, in comparison with similar data for the year 1905.

AGRICULTURAL EDUCATION.

Agricultural education, J. S. STEWART (*Athens, Ga.: Author, 1906, pp. 7*).—Condensed report of an address before the Georgia Educational Association, June 22, 1906. The three tests—usefulness, furnishing mental discipline, and having cultural value—are applied to the subject of agriculture to determine whether it is worthy a permanent place in the curricula of schools and colleges. The writer believes that it meets all of these tests and outlines a scheme for agricultural schools in Georgia.

The educational element in agriculture, J. M. COLSON (*South. Workman, 35 (1906), No. 9, pp. 504–507*).—An address before the Virginia State Teachers' Association, in which a discussion is given of the educational value of agriculture and a plea made for its introduction into public schools.

Agriculture (*Manual and Guide and Course of Study for the Common Schools

of South Dakota. Mitchell, S. Dak., 1906, pp. 147–163).—This is a course of study prepared by J. W. Wilson, N. E. Hanson, and W. A. Wheeler, and consists mainly of general exercises and observations.

Elements of agriculture (*Manual of the Elementary Course of Study for the Common Schools of Wisconsin. Madison, Wis.: State Supt. Pub. Schools, 1906, pp. 222–236*).—This course in elementary agriculture for the public schools of Wisconsin is divided into agriculture (agronomy), farm animals, and farm poultry. Under agronomy the following topics are discussed: Aims, the soil, water and the soil, tilling the soil, soil enrichment, the plant, the leguminous plants, plant enemies, rotation of crops, selection of seed, the farm garden, weeds, and home and school gardens. Under farm animals, care and feeding, type forms, and farm economics are considered.

Elementary agriculture with practical arithmetic, K. L. HATCH and J. A. HASELWOOD (*Chicago: R. K. Row & Co., 1906, pp. 207, pl. 1, figs. 47*).—This is a text-book of agriculture suitable for use in elementary rural schools. It treats in a brief but logical way of plant and animal production and devotes some space to farm mechanics and economics.

The plan of treatment is indicated by the following subjects of chapters: Why plants grow, the plant and the water, plant foods, soils, the soil and the crops, wearing out the soil, legumes, tilling the soil, draining the soil, the crop, insects and diseases that injure the crops, the fight against weeds, the stock on the farm, feeding the stock, the three c's—cows, corn, and clover, the dairy, poultry, some special crops, farm buildings, farm accounts, forestry, home and school grounds, school gardening, and home gardening. There is also an addendum containing plans for the construction and ventilation of barns and score cards for judging corn, beef cattle, dairy cattle, draft horses, swine, and mutton sheep.

The feature which distinguishes this text-book from any other that has appeared in this country is the nature of the practicums, which consist of problems in agricultural arithmetic. There is a total of 274 of these problems, of which there are from 6 to 24 following each chapter and related to the subjects discussed in that chapter. There are also scattered through the text numerous tables taken from the publications of this Department and adapted to the needs of the text-book, as well as numerous references to the bulletins and other publications of this Department.

Teaching horticulture in public schools, E. V. HALLOCK (*Amer. Florist, 27 (1906), No. 951, pp. 216, 217*).—This is a report of a special committee of the Society of American Florists, presented at the meeting of the society in Dayton, Ohio, August 21, 1906. In it are discussed such matters as text-books, standardizing courses of study, instructions to teachers, lectures, and children's gardens conferences. A plan for garden work and instruction in horticulture is given in outline form.

The use of illustrative material in teaching agriculture in rural schools, D. J. CROSBY (*U. S. Dept. Agr. Yearbook 1905, pp. 257–274, pls. 3, figs. 10*).—In this article the writer discusses the value of agriculture in rural schools, describes methods employed in teaching this subject in a consolidated school in Tennessee, in a village high school in Pennsylvania, and in a country high school in Kansas, describes 8 exercises which can be performed with simple and inexpensive apparatus, and discusses agriculture as an aid to other school work.

Nature study and elementary agriculture for the elementary public schools, A. C. TRUE and D. J. CROSBY (*West. Jour. Ed., 11 (1906), Nos. 4–7, pp. 8–24*).—This article was prepared at the request of a committee appointed at a meeting of the State Teachers' Association and the State Farmers' Institute at Berkeley, Cal., December 26–29, 1905, and is intended to show in some detail

the topics which should be included in nature study and elementary agricultural instruction and the methods which should be followed in this work. It was prepared to meet the conditions existing in California schools, and is divided into 3 parts to correspond to the grouping of grades already recognized in that State, viz, nature study for Group I (grades 1–3), nature study for Group II (grades 4–6), and elementary agriculture for Group III (grades 7 and 8). The topics to be discussed in nature study and elementary agriculture are given in the order of treatment recommended, and the use to be made of school gardens and other practicums is discussed. A number of practicums are outlined, and lists of books and other publications on nature study, school gardens, and elementary agriculture are given. The references to works on elementary agriculture are arranged according to the divisions of this subject, viz, plant production, animal production, dairying, rural engineering, and rural economics.

The foundations of chemistry as seen in nature study, J. BRITTAIN (*Ottawa Nat., 20 (1906), No. 4, pp. 89–92*).—Simple experiments with wood, sugar, starch, and other carbohydrates to illustrate chemical union and show the presence of carbon and water in these substances.

MISCELLANEOUS.

Yearbook of the Department of Agriculture, 1905 (*U. S. Dept. Agr. Yearbook 1905, pp. 815, pls. 73, figs. 130*).—The Yearbook for 1905 contains a report of the Secretary on the work of the Department during the year, 30 special papers abstracted elsewhere in this issue, and an appendix consisting of an agricultural directory, a review of the progress in different lines of agriculture, and agricultural statistics.

Some ways in which the Department of Agriculture and the experiment stations supplement each other, E. W. ALLEN (*U. S. Dept. Agr. Yearbook 1905, pp. 167–182*).—The more important features of the Department and experiment station work are briefly set forth. The survey shows that while some lines of work are being carried on primarily by the Department, some by the stations, and some by the two agencies working in cooperation, there is, in the words of the author, a mutual interdependence which has affected the work of both to a very great degree and has contributed materially to its scope, efficiency, and application in practice.

Report on agricultural investigations in Alaska, 1905, C. C. GEORGESON (*U. S. Dept. Agr., Office Expt. Stas. Bul. 169, pp. 100, pls. 8, fig. 1*).—This is a report on the several lines of work which have been carried on during the year at the Sitka, Copper Center, Rampart, and Kenai stations. Extensive tests have been made with field and horticultural crops, and some work with live stock has been undertaken. In addition to the results of experimental work noted elsewhere in this issue, notes are given on weather conditions in Alaska, the reservation at Fairbanks, the number of homesteads in Alaska, imports of farm products into Alaska, the forests in the interior of the Territory, and on other topics.

Report on agricultural investigations in Hawaii, 1905, J. G. SMITH (*U. S. Dept. Agr., Office Expt. Stas. Bul. 170, pp. 66, pls. 4*).—This consists of a general review of the work of the station during the year, results of experiments with tobacco and other crops, and reports of the chemist, entomologist, and horticulturist. The experimental work is for the most part noted elsewhere in this issue.

Report on agricultural investigations in Porto Rico, 1905, D. W. MAY (*U. S. Dept. Agr., Office Expt. Stas. Bul. 171, pp. 47, pls. 7*).—This contains a brief summary of the results of experiments with various crops, notes on live

stock in Porto Rico, and reports of the entomologist and botanist, the horticulturist, and the coffee specialist. The experimental work is noted elsewhere in this issue.

Nineteenth Annual Report of Arkansas Station, 1906 (*Arkansas Sta. Rpt. 1906, pp. VIII+77–210*).—This includes the organization list of the station, a brief report of the director, giving the subjects of the bulletins issued during the year, a financial statement for the fiscal year ended June 30, 1906, and reprints of Bulletins 88–91 issued during the year.

Eighteenth Annual Report of Massachusetts Station, 1905 (*Massachusetts Sta. Rpt. 1905, pp. 254*).—This includes the organization list of the station, a report of the director, a financial statement for the fiscal year ended June 30, 1905, and departmental reports abstracted elsewhere.

Nineteenth Annual Report of Nebraska Station, 1905 (*Nebraska Sta. Rpt. 1905, pp. 117*).—This contains the organization list of the station, a review of the work of the station by the director, a financial statement for the fiscal year ended June 30, 1905, and miscellaneous articles abstracted elsewhere.

Fifteenth Annual Report of Oklahoma Station, 1906 (*Oklahoma Sta. Rpt. 1906, pp. 13–63*).—This contains a report of the director, a summary of the press bulletins issued during the year, meteorological observations noted elsewhere, and a financial statement for the fiscal year ended June 30, 1906.

The press bulletins are to a large extent a repetition of matter published in the regular bulletins of the station. The subjects treated include: Hardy Bermuda grass, Bermuda hay, wheat experiments, pasturing wheat 1904–5, harvesting cowpeas, destroying weevils in cowpeas, soy beans as a catch crop, storing sweet potatoes, small fruits, planting trees, pear blight, spray for profit, fungicides, insecticides, remedies for chinch bugs, poisoned bran for cutworms and grasshoppers, the cotton square borer, soil inoculation, blackleg vaccine, and horse breeding.

Annual Report of Pennsylvania Station, 1905 (*Pennsylvania Sta. Rpt. 1905, pp. 236*).—This contains the organization list of the station, a financial statement for the fiscal year ended June 30, 1905, a report of the director on the work of the station during the year, and departmental reports, parts of which are abstracted elsewhere. The report also contains reprints of Bulletins 71–75 of the station, already noted, and of an article on the energy value of red clover hay and corn meal (E. S. R., 17, p. 579).

Twenty-second Annual Report of Wisconsin Station, 1905 (*Wisconsin Sta. Rpt. 1905, pp. 397*).—This contains the organization list of the station, a report of the director, including a subject list of station publications, numerous articles abstracted elsewhere, lists of exchanges and acknowledgments, and a financial statement for the fiscal year ended June 30, 1905. Two articles are reprinted from Bulletin 129 of the station (E. S. R., 17, p. 498).

Accessions to the Department Library, April-June, 1906 (*U. S. Dept. Agr., Library Bul. 60, pp. 64*).

NOTES.

Georgia Station.—Martin V. Calvin, of Richmond, Ga., has been elected to succeed R. J. Redding as director.

Kansas College and Station.—According to the *Industrialist*, J. E. Payne has been selected to take charge of the station at Garden City, to be conducted in cooperation with this Department. The college has a total enrollment of 1,356, a gain of about 200. The State legislature will be asked to appropriate $670,500 for the next biennium. Of this amount $295,000 is for current expenses.

Louisiana Stations.—Fritz Zerban, Ph. D. (Munich), has succeeded to the place of Dr. C. A. Browne, jr., as chemist at the sugar station. R. C. Holtzclaw, formerly assistant chemist at the State station, has been recently appointed assistant to the State chemist of Georgia.

Maine University and Station.—Percy Campbell has been appointed assistant in animal husbandry.

Massachusetts College and Station.—M. A. Blake, assistant in horticulture, has resigned to become horticulturist at the New Jersey State Station. The vacancy previously noted, caused by the resignation of F. G. Helyar, has been filled by the appointment of W. K. Hepburn.

Michigan College.—The campus has been extended by moving all of the older barns back 200 or 300 yards to an elevated position on the river bank. It is proposed eventually to erect a new agricultural building on the site thus vacated. A new engineering building is in process of erection. It is to consist of a stone and brick basement, above which will be four stories of vitrified brick, trimmed with white sandstone. This is to contain class rooms and laboratories for the departments of mathematics, physics, drawing, and civil and mechanical engineering. The old mechanical building will be devoted to shopwork.

Plans are being perfected for a jubilee week next spring to celebrate the fiftieth anniversary of the opening of the first agricultural college in the United States. It is now proposed to hold the jubilee May 28–31. A programme is being arranged so that the delegates to the Association of American Agricultural Colleges and Experiment Stations, which it is hoped will meet in Lansing at that time, may attend all of the more important sessions of the jubilee. President Roosevelt will speak May 31, and the college is planning to entertain from 10,000 to 15,000 people on that day.

Minnesota Station.—A. D. Wilhoit has been appointed assistant in soil investigations, and George Craig assistant in animal breeding experiments.

Mississippi College and Station.—D. C. Mooring has been oppointed assistant in horticulture. E. R. Lloyd is to have charge of the farmers' institute and extension work. J. W. Fox has been put in charge of the Delta substation and C. T. Ames of the Holly Spring station.

Nebraska University and Station.—Martin Nelson has been appointed instructor in field crops and soils in the university and assistant in crops in the station.

New Hampshire College and Station.—Harry F. Hall, formerly assistant in horticulture, has been appointed horticulturist to succeed F. W. Rane, whose resignation has been previously noted.

Cornell University and Station.—Charles H. Tuck, a graduate of the university in 1906, has, according to the *Cornell Countryman*, been appointed supervisor of the farmers' reading courses, vice G. W. Horsford, who has entered the employ of this Department. Henry Jennings, a former student, is reported as having accepted a position as poultryman at the Maryland Station. Dr. C. H. Roberts, a practicing dentist of Ulster County, N. Y., has recently endowed five scholarships in the College of Agriculture, donating $30,000 for the purpose.

Oregon College and Station.—C. E. Bradley, formerly head of the chemical department of Pacific University, has been appointed assistant chemist in the station, and W. H. Wicks, a graduate of the Oregon College, has been appointed assistant horticulturist. A contract has recently been let for the erection of a women's building, to cost $71,300.

Virginia College and Station.—Dr. J. M. McBryde has been tendered a pension under the retirement fund of the Carnegie Foundation for the Advancement of Teaching. It is reported that he will retire at the close of the present college year.

The director and several members of the station staff were charged with the management of the live stock department of the State fair, recently held at Richmond. The station made an exhibit of potatoes, tobaccos, and cereals in the grain and straw, which attracted a great deal of attention. A working dairy was also operated during the fair.

Armour Agricultural Scholarships.—J. Ogden Armour has offered to the president of the International Live Stock Exposition the sum of $5,000 to be distributed annually at the exposition in 20 agricultural scholarships to be competed for by the State agricultural colleges at the exposition. In a letter to the president of the exposition he states that these scholarships are given in recognition of the work done by the agricultural colleges "in advancing the cause of agricultural education in this country through the character and extent of their exhibits of live stock and field products at the international show."

The competition is to be based upon the animal and grain exhibits from the several colleges and such other forms of agricultural student competition as may be recognized or established by the exposition. The details are to be determined by the management, and the scholarships are to be known as the J. Ogden Armour scholarships. The gift has been accepted by President Spoor.

Meeting of the International Congress of Applied Botany.—A meeting of the committee on applied botany, appointed by the Botanical Congress of Vienna in 1905, was held in Paris August 25 and 26, 1906, for the purpose of organization and formulating plans for investigation. The committee adopted as a preliminary programme a resolution providing for the appointment of a competent investigator to visit all parts of the world and study what has been done in applied botany along the lines of agriculture and horticulture, and the methods and facilities of such investigations. This inspection is to be made and a report submitted at the next meeting of the association in 1908. To meet the expense of this trip the committee undertakes to raise a fund of $4,000 by subscriptions from societies and individuals interested in the various lines where botany touches upon agriculture and horticulture. The choice of the traveling inspector was left to a committee consisting of Messrs. Fruwirth, de Jaczewski, Marchal, Ph. de Vilmorin, and Trabut.

A second committee, consisting of de Jaczewski, Proost, Schilbersky, Trabut, and Brick, was appointed to make a study and report upon the legal means adopted by all countries to prevent the introduction and spread of plant para-

sites. A zoologist is to be added to this committee, and insect pests will be included in the report.

Professor Flahault accepted a commission to prepare a catalogue showing regions of similar climatic conditions as indicative of their possibilities in applied botany.

Southeastern Iowa Short Course.—Special arrangements have been made for short courses in corn and live-stock judging and domestic science, to be held under the management of the Young Men's Christian Association in its new building at Mount Pleasant, Iowa, December 17–22. The Iowa Agricultural College will cooperate with those having the course at Mount Pleasant in charge. The classes in live-stock judging will be conducted by Professors Curtiss and Bliss, of Ames, in the new pavilion at the fair grounds, and the corn judging will be in charge of Professor Holden and assistants. During the week lectures will be given by President Storms and Doctor McNeil, of Ames, G. M. Rommel, of this Department, and others.

Agricultural Education in Hungary.—New regulations for the Royal Hungarian Horticultural School at Budapest provide that only applicants 20 years old or more, who have finished the sixth grade in public schools and have had one year of practical experience in gardening, can be admitted. Among the technical subjects taught in the course are garden architecture, machines and implements, landscape gardening, garden management, agriculture, farm economics, and farm law.

The agricultural academy at Magyar-Ovar is so crowded that it is recommending students to go to other agricultural academies in Hungary where the qualifications for admission to the Magyar-Ovar Academy will admit them to the second year.

School for Meadow Culture in Austria.—A meadow culture school was opened at Eger November 1, which is temporarily in charge of Franz Lindner, director of the agricultural school at Eger.

Forestry at Oxford.—A three-year forestry course is now provided at Oxford. Two years of the course are spent at the university and the third year on the Continent. Candidates for the Indian forest service are selected partly by examination held by the civil service commissioners and partly by nomination. Candidates who have taken the full course and secure appointments receive about $1,500 the first year, and the grading is such that the final salary may reach $10,000 a year. At the end of twenty-two years Indian forest officers can retire on a full pension, the maximum being about $2,500 per year.

Butter Competitions.—According to the *Journal of the Board of Agriculture*, the department of agriculture for Ireland has been holding a novel form of dairy competition during the past few years. The butter exhibited at such competitions is arranged for by telegrams dispatched by the department on the morning of the day on which the exhibits are to be held. The competitors are unaware of the dates, and the constant daily attention which must accordingly be given the work is one of the principal advantages which accrue from this system.

Allotments to Agricultural Laborers in Denmark.—The Danish Government has recently undertaken an inquiry into the results obtained from the act of 1899 as amended in 1904. Under this act laborers who are able to provide suitable buildings, stock, implements, etc., may borrow from the state sums equal to nine-tenths of the mortage value of the property to be obtained. The interest on the loan is 3 per cent, and no principal can be paid during the first five years. After that 4 per cent is to be paid on two-fifths of the loan for interest and principal, and the remainder of the loan is to be repaid later at the same rate.

During the five years in which the act has been in operation 1,859 allotments were acquired in this way, with loans amounting to $1,815,000. The great majority of the owners were agricultural day laborers, and the total area of their holdings amounted to 14,552 acres, or nearly 8 acres each. The majority of the holders were members of cooperative societies, nine-tenths being members of cooperative dairies, one-third members of bacon-curing societies, and one-fourth members of societies for the cooperative sale of eggs.

Miscellaneous.—The annual meeting of the New York State Association of School Commissioners and Superintendents was held at Cornell University October 3 to 5. Considerable attention was given to a discussion of the best means of adapting rural schools to their environment. The consensus of opinion was that such schools should not teach agriculture separately, but as a part of the general scheme of pedagogy, of which it should be the basic factor.

Mark Lane Express states that negotiations are now proceeding whereby the Midland Agricultural College of Leicestershire is to be converted into a college of agriculture of the proposed Nottingham University. Authority will then be granted to confer degrees, which is not now permitted.

It is learned from the same source that the agricultural department of Leeds University is endeavoring to revive interest in the canning industry. Lectures are being given by a member of its staff on the canning and preserving of fruit in various centers in the vicinity.

At the celebration of the 400th anniversary of the foundation of the University of Aberdeen a new block of buildings, costing over $1,000,000, was formally opened by the King. The buildings include extensive class rooms and laboratories for agriculture.

The October number of *Forestry and Irrigation* states that R. C. Bryant, for some time in charge of the cooperative work of the office of Forest Extension, of the Bureau of Forestry, has recently resigned to assist in organizing the work in connection with the chair of practical forestry and lumbering at the Yale Forest School. This chair was established by subscriptions from leading lumbermen throughout the country.

J. B. Mowry has been appointed commissioner of forestry in Rhode Island.

J. J. Dearborn, of the Harvard Forestry School, has become assistant to F. W. Rane, State forester of Massachusetts.

The death of B. Chauzit, director of the Departmental Agricultural Laboratory, at Nimes, and since 1882 departmental professor of agriculture in Gard, is noted in a recent number of *Progrès Agricole et Viticole*.

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EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, Ph. D., *Assistant Director.*

EDITORIAL DEPARTMENTS.

Meteorology, Soils, and Fertilizers—W. H. Beal.
Agricultural Botany and Vegetable Pathology—W. H. Evans, Ph. D.
Field Crops—J. I. Schulte.
Horticulture and Forestry—C. B. Smith.
Zootechny and Human Nutrition—C. F. Langworthy, Ph. D.
Agrotechny, Dairy Farming, and Dairying—H. W. Lawson.
Agricultural Chemistry—W. H. Beal, C. F. Langworthy, and H. W. Lawson.
Economic Zoology, Entomology, and Veterinary Medicine—E. V. Wilcox, Ph. D.
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NOTE.—The publications of the United States Department of Agriculture, except those of the Weather Bureau, may be purchased from the Superintendent other technical publications are given in the list above. The publications of the requests and remittances should be directed to the Chief of the Bureau. The price of the Record is $1 per volume, or 10 cents per number. The prices of other technical publications are given in the list above. The publications of the State experiment stations are distributed from the stations and not from the Department.

EXPERIMENT STATION RECORD.

Vol. XVIII. December, 1906. No. 4.

The convention of the Association of American Agricultural Colleges and Experiment Stations at Baton Rouge was one of unusual interest, especially to experiment station officers. The chief center of interest was the Adams fund, its aims and limitations, and the general policy regarding its use.

There was a broad discussion of the subject of research work, its relation to the other activities of the experiment stations and to the general public. At no previous meeting has there been so full and intelligent consideration of this subject and of the distinctive features of research and investigation. It did much to clarify views and elevate ideals, if it did not always relieve the feeling of pressure on the part of some that the needs and demands of their constituents should be met in a direct way. Such, however, could hardly fail to have carried away a clearer impression of the desirability of agricultural research and of its practicability as well.

The broad field and duty of the experiment station as a scientific institution was emphasized—its relations to agricultural education and to the promotion of agriculture in a broad sense, as well as to the local needs of the farmer. The need of a definite policy for every station and of adherence to its policy and programme of work was made evident, a need which is especially urgent at the present juncture.

The report of the new standing committee on station organization and policy was received with special interest. This committee is made up of a representative body of station men, headed by Dean Davenport as chairman. It has held several meetings during the year and has given careful and intelligent study to questions relating to the policy of the stations toward the Adams fund. Its conclusions are therefore entitled to much respect, and should have great weight in formulating the sentiment of the American stations.

While the committee deemed it impracticable at this time to determine in detail the kinds of work proper under the new fund, it laid down the following broad proposition: "It is evidently the inten-

tion of the Adams Act to provide the means for carrying on investigations of a relatively high order, with a view to the discovery of principles and the solution of the more difficult and fundamental problems of agriculture. To this end it is very desirable that careful attention shall be given to the choice of definite problems to be studied and the methods by which the solution of these problems is to be sought. Investigations in connection with which there is good reason to expect the establishment of principles of broad application should be preferred to those which have only local or temporary importance, or from which only superficial results are to be obtained."

The greatest evident difficulties in planning work under this new act were shown by the data collected by the committee to be (1) a lack of clear discrimination between investigation in a strict sense and the ordinary experimental work, (2) a lack of definiteness in the purpose and plan of the investigations, (3) a tendency to take up too large or broad problems, and (4) the outlining of too large a number of projects. "In the abstract everybody agrees with the purpose of the Adams Act and the desirability of restricting the fund closely to original investigations. When we come to concrete cases, however, there is very great difference of opinion." This was attributed in part to a habit of mind which has led to the designation of relatively simple experiments and tests as "investigations," although evidently not so in any real sense, and to a biased judgment which places undue stress upon demonstration work and the attainment of immediately practical results. Upon the latter point the committee said:

"The mental attitude of many of our station workers is wrong. They see only the immediate duty of the station to the local farmer of to-day. They forget that the station has a duty to all phases of agriculture in a broad sense, and that this may lead to much more permanent and widespread benefit. The development of agricultural education has come very largely as a result of station work. The stations have furnished the stock in trade of the agricultural instructor, and their work has been the means of putting agricultural instruction on a better pedagogic basis. They owe a duty to agricultural education and agricultural science which it is very important should be more generally recognized. The Adams fund will enable them to more largely meet this duty, and at the same time to lay a broader and more substantial basis for the science as well as the art of agriculture. In most States this new fund can safely be used for investigation which will not necessarily give an immediate return to the farmer, for the other funds will usually take care of the demands of the farmer sufficiently to keep him satisfied."

This is a broad conception of the stations' mission. Without disparaging any form of activity in the aid of agriculture, it calls atten-

tion to a too narrow view, which has often obscured our vision and had a noticeable effect upon the station workers themselves. In this it has struck a very vital part, for the aim and work of a station are determined in large measure by the men composing its staff. The commanding position of the man as the most important factor in research was strongly emphasized by the committee, and almost as a corollary to this it was urged that "the man and his line of work must be suitable to each other."

The latter is an important item which in the exigencies of station work has not always been given due consideration. It recognizes that men have special qualifications which should be discovered and encouraged. It is useless to try to exact research from a man whose interest and ability lie in demonstration and extension work, and it is a waste of good material to require extensive institute work of an investigator who has little heart in institute work and finds it uncongenial. While most stations can as yet specialize and differentiate to only a limited degree, they can in large measure relieve their research men of duties which are onerous to them, and utilize them more largely and more advantageously in lines in which their special qualifications and special interests lie.

Regarding the training of station workers, the committee held it to be "more important that a man be thoroughly educated in the fundamentals of science than that he be trained in some of its applications," since the man of thorough scientific training can readily acquire the known facts and point of view in the agricultural application of the science, while the other hopelessly lacks the basal knowledge of the science.

The high ideals set forth by this committee received the approval of the association in the adoption of the report, and the discussion of it was in accord with the view that research is the life of progress in agriculture, and that a point has been reached in our station work where it is imperatively necessary.

One session of the section on experiment station work was devoted to an open discussion upon The Kind and Character of Work under the Adams Act, and the Society for the Promotion of Agricultural Science, which met just prior to the convention, held a symposium on experimental work, which was occupied largely with this general subject.

In the latter, papers were presented by Prof. Thomas F. Hunt on What is Research?; by Dr. H. J. Wheeler on Tendencies in Station Work as Influenced by the Conception of Scientific Investigation, and by Director C. D. Woods on The Experiment Stations and the Adams Act. These papers were followed by a general discussion, and later by the presidential address of Dr. H. P. Armsby.

Doctor Armsby pointed to the popularity of the experiment stations as their greatest danger, since it "threatens to be their permanent undoing as agencies of scientific research." He urged the importance—nay, the necessity—of research as a basis for the development of agricultural education and of improved practice, and pointed out that the public needs to understand better than it does the nature and the importance of research. "Unless science makes progress, practice will mark time." Considering the provision for agricultural research which the Adams Act makes, he cautioned that this act may "prove also to be a day of judgment for the stations, in that it will reveal to all men their conception of original research and demonstrate whether or not they have a broad fundamental grasp of the idea of investigation. Differences of opinion regarding the application of this fund are already apparent. The stations stand at the parting of the ways. Will they simply add demonstration to demonstration, propaganda to propaganda, or will they grasp the opportunity to dedicate this new fund sacredly and irrevocably to original scientific research, broadly conceived and liberally executed?"

The discussion in the section on experiment station work served to reenforce the general opinion that the new fund should be used for investigation in a strict sense, and by illustration it helped to show the distinguishing characters of such work and to bring out the distinction between information, facts, and knowledge. Information may be of a very general nature, entirely empirical in character, and bear no relation to the cause or reason. Much that we publish as a result of our experiments is merely statistical information, with no attempt to trace the why or wherefore. A fact implies something more definitely established, but this may not be true of its relationships to other facts or observations. Isolated facts are often valuable when rightly applied, but it is when they are correlated into knowledge that they have their full value and contribute definitely to our understanding of principles.

As Doctor Armsby said in his excellent paper on Problems of Animal Nutrition, "one principle well founded is worth a thousand facts, because it includes them all;" and he added, referring to the subject under discussion, "I can not avoid suspecting that the principles which have been borrowed from foreign investigators and popularized by station literature and in other ways have done quite as much to help the practical feeder as our own experiments."

The principal doubt expressed in connection with the inauguration of research work was as to the attitude of the constituents of the station, and the ability to suppress their impatience for results. This difficulty is believed to be in a measure overestimated. While it is

true that the public does not like long-time investments and wants to see the results or the prospects of them, it is also true that it has made great strides in the appreciation of scientific investigation of agricultural problems, and has become more patient to wait until safe results can be secured. In some quarters it has already become impatient of inconclusive work. It can be interested in investigations into the why and wherefore as it could not have been a few years ago, and this tendency, it is believed, can be developed and intensified.

Education will do much to remedy this condition. It is not so many years since the only interest of the farmers in some sections was in substations and simple demonstrations. Now it goes much further. We should not yield to this apparent obstacle, although we recognize it and take account of it in the selection of our research problems. Many of these may be made to appeal to the farmer if they have a definite aim, and at least a considerable number of men can be made to see their importance, even though they be quite technical, and to support the station in the undertaking.

Take a specific case: Tomatoes grow luxuriantly in a certain State but tend to set fruit only sparingly. This is not a varietal characteristic, is not local, and does not appear to yield to the usual cultural methods. The cause for it is unknown. It may, it is thought, have some connection with the semiarid condition of the soil or atmosphere, the richness of the soil or its deficiency in some fertilizing element, or it may be due to other causes. It is a live, practical question. The station in that State might conduct a variety of field trials, working in the dark, in the endeavor to hit upon some method which would increase the tendency to set fruit; or it can, as is proposed, conduct a systematic investigation into the cause of this phenomenon, eliminating the effect of various factors one by one, and studying the problem in its physiological considerations as a basis for practical deductions.

The chances for ultimate practical results are greater in the latter case than in the former. Moreover, the work will be thoroughly done as each phase is taken up, and results of scientific interest will be secured which may quite likely have a bearing upon other crops. Is the matter of less interest to the practical man because it is carried out in this thorough scientific way and he can not understand each step? And is he more likely to become impatient at delay than if miscellaneous field trials were made without any reference to the fundamental cause? It hardly seems likely, if he is given to understand that the station is addressing itself to the practical problem to the best of its ability.

But there are other problems whose practical relations seem more remote to the general public, and which have to be taken by them on faith. In a considerable number of States such researches can not

be undertaken with the present public sentiment, and we must look to States where this sentiment is more advanced and where the demands on the station are less insistent. Some of these researches have become indispensable to further progress and are of interest to all the stations, although only a few can enter upon them. In some instances we lack both the men and the equipment to carry them on in more than one or two places at the outset, and where these men and facilities exist the great desirability of encouraging development to the fullest extent seems to need no argument.

This view was expressed by the section on experiment station work in reference to the investigations upon the principles of animal nutrition made with the aid of the respiration calorimeter at the Pennsylvania Station. The section commended this work in highest terms, recognizing its importance in the development of animal feeding; and in view of the special facilities combined at the Pennsylvania Station in investigator and apparatus, expressed "its earnest hope that at this time, when plans are being laid for so wide an extension of research in agriculture in the United States under the Adams Act, that the line of research already established by the Pennsylvania Station will be continued and developed to the fullest extent deemed practicable by the board of control."

The keynote of the discussion at the Baton Rouge meeting was that the provision for genuine research in agriculture had come none too soon, that our ideals should be set high, and that an enlightened public sentiment should be developed in the individual States as a foundation and support for it. In this advanced work public sentiment must be led. It can not be expected to lead the stations, as it often has in the case of the more practical work. The idea should be spread abroad that they can not solve fundamental problems at short order or get results of worth under high pressure. Given the proper aim, the stations must be allowed to work out the problems of agriculture in their own way.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

On methods of determining phosphoric acid in artificial fertilizers, P. CHRISTENSEN (*Tidsskr. Landökonom., 1906, No. 5, pp. 308–312*).—This is a résumé of a monograph by the author on the subject.

The results of determinations of water-soluble phosphoric acid in the same superphosphates were found to differ as much as 0.75 per cent according to the modifications of the molybdate method proposed by Fresenius, Wagner, and Maercker. Similar differences were found in the results for citrate-soluble phosphoric acid in Thomas slag, and in the case of total phosphoric acid in bone meal differences of 1 per cent or more were obtained by the various methods. The differences were shown to depend on the manner of precipitating with magnesia mixture, and a method of procedure was worked out by the author which gave correct results. A rapid "direct molybdate" method is recommended for further trial. The yellow precipitate formed by addition of ammonium molybdate is ignited to constant weight, and the residue weighed for calculation of the per cent of phosphoric acid in the fertilizer. The methods are not described.

The author found that bone meal containing 31 per cent total phosphoric acid gave 30 per cent of phosphoric acid soluble in a 2 per cent citric-acid solution. Its citrate solubility was therefore equal to that of Thomas slag. It follows that phosphoric acid in bone meal must either be equal to that of Thomas slag or, if experience and exact culture trials show it to be less valuable, the present method of valuation of phosphoric acid in Thomas slag can not be considered reliable.—F. W. WOLL.

On the rapid analysis of superphosphates, M. JACQUET, G. QUINTANILLA, and F. ARREDONDO (*Rev. R. Acad. Cien. Madrid, 4 (1906), No. 5, pp. 592–598*).—The method proposed is as follows: Grind 2.5 gm. of the superphosphate in a mortar with about 15 cc. of cold distilled water, filtering the extract and repeating the operation until the filtrate amounts to about 200 cc., finally washing the filter with water at 80° C. After cooling add 1 or 2 cc. of nitric or hydrochloric acid to clear up the solution. Digest the filter and contents in 100 cc. of Joulie's citrate solution (400 gm. citric acid per liter) at 60° C. on a water bath for 3 hours, stirring for 1 or 2 minutes every quarter of an hour. Make the solution to 250 cc. To 50 cc. portions of the water and citrate solutions add 100 cc. of 22° ammonia and 10 to 15 cc. of magnesia mixture ($55MgCl_2+105NH_4Cl+350NH_3$ of $22°+H_2O$ to one liter). Shake in a mechanical agitator making 40 to 50 revolutions per minute for 3 hours, collect the precipitate on a filter, and proceed as usual. This method gave results with a variety of materials closely agreeing with those obtained by the ordinary method. Increasing the revolutions of the shaker to 70 to 80 per minute and reducing the time to 1 hour gave higher results than those yielded by the ordinary method.

Investigations on the causes of error in the application of the citro-

mechanical method in the determination of phosphoric acid in natural phosphates and phosphatic slag, H. Pellet (*Ann. Chim. Analyt., 11 (1906), No. 9, pp. 331, 332; abs. in Chem. Centbl., 1906, II, No. 16, p. 1284*).—The author briefly discusses the investigations of Guerry and Toussaint (E. S. R., 18, p.107) on this subject and describes the method which he employs to remove silicic acid from solution, namely, moistening with hydrochloric acid, evaporating to dryness, and taking up in hot hydrochloric acid. It is claimed that the removal of silica is not necessary in the molybdic method, and that a precipitate of phospho-ammonium molybdate of definite composition can always be obtained.

On the determination of phosphoric acid as magnesium pyrophosphate, B. Schmitz (*Ztschr. Analyt. Chem., 45 (1906), No. 8, pp. 512–522; abs. in Chem. Centbl., 1906, II, No. 10, p. 911*).—The author precipitates the nearly neutralized (with HCl) ammonia solution of the molybdic precipitate with acid (HCl) magnesia mixture, finally making the solution alkaline with ammonia.

Should one titrate calcareous marl with sulphuric acid? Schulze (*Chem. Ztg., 30 (1906), No. 77, pp. 937, 938*).—A series of comparative tests is reported which showed that the use of sulphuric acid gives uniformly lower results than hydrochloric acid, but the reason for this is not made clear.

The determination of organic matter in waters by means of potassium permanganate, A. Garcia (*Ann. Chim. Analyt., 11 (1906), No. 9, p. 340*).—The author finds that the ammonia already present or set free from salts or organic matter in water by alkaline permanganate is oxidized to nitrous or nitric acid, which increases the amount of permanganate required, and thus alkaline permanganate gives higher results for organic matter than acid permanganate.

The detection of humus substances in water, Klut (*Pharm. Ztg., 51 (1906), pp. 777, 778; abs. in Chem. Centbl., 1906, II, No. 13, p. 1081*).—It is stated that no typical reaction for this purpose exists. Various indirect tests for color, odor, reaction, etc., are described.

A new method for the quantitative estimation of pentosans, A. Jolles (*Ztschr. Analyt. Chem., 45 (1906), No. 3–4, pp. 196–204*).—Detailed directions are given for estimating furfurol, and data are reported showing the accuracy of the method, which consists essentially in boiling the substance to be tested with hydrochloric acid, distilling with water vapor the furfurol formed, neutralizing with sodium-hydroxid solution, adding bisulphate solution, and titrating with iodin.

On uniform methods of analysis of cane factory products, H. Pellet (*Internat. Sugar Jour., 8 (1906), No. 94, pp. 506–511*).—Notes are given on the steps which have been taken toward securing unification of the methods for saccharine products in different countries. Analyses of cane molasses made by three methods are given to illustrate the differences arising from the use of different methods. Comments are made on the suggestions which have been offered for the unification of methods and a résumé of methods for the analysis of molasses is given.

An accurate commercial method for the analysis of sugar beets, D. L. Davoll (*Internat. Sugar Jour., 8 (1906), No. 94, pp. 512–516, fig. 1*).—Objections to the method of hot-water digestion are overcome, according to the author, by substituting a beaker for the flask, and finally completing the mass to a certain weight, 209.2 gm., instead of volume. By this method, which is described, it is possible to make from 600 to 700 analyses in one day, instead of 125 by the usual method.

Report on the estimation of glucose by the volumetric method, A. Watt (*Internat. Sugar Jour., 8 (1906), No. 94, pp. 502–506*).—In determining glucose

in beet sugar it is considered important to standardize the Fehling solution with a solution of pure sucrose and invert sugar in the proportions found in the sample. If a clarified solution is used it is also considered necessary to clarify the standardizing solution before titration. When these precautions are taken the volumetric method is believed to be capable of giving as accurate results as the gravimetric method.

The method of analysis of milk used in the government laboratory for samples referred under the sale of food and drugs acts, H. D. RICHMOND and E. H. MILLER (*Analyst, 31 (1906), No. 367, pp. 317–335*).—In the case of fresh milk the maceration method employed in the government laboratory is believed to give results which are accurate for fat, but slightly too high for solids-not-fat. The higher results for the solids-not-fat are attributed in part to the occurrence of sugar in the hydrated form and to the presence of aldehyde in the ether.

In 18 out of 19 analyses of samples of sour milk the authors report fair agreement of the figures for fat by the maceration method with those obtained by the Gottlieb method on the fresh samples. A considerable variation in the remaining sample was attributed to an unusual decomposition.

The main part of the paper deals with the corrections allowed for decomposition products in calculating the composition of the fresh milk when the sample examined has undergone fermentative changes. The method employed in the government laboratory makes corrections for alcohol, volatile acids, and ammonia, and is believed to give results within 0.2 per cent of the truth except in cases of high butyric fermentation or other abnormal decomposition. The authors believe that certain small additional corrections may be made with advantage and suggest allowance for lactic acid, butyric acid, and the aldehyde taken up from the ether used.

The work, on the whole, indicates that the government laboratory method is substantially accurate for the usual samples, but that special corrections ought to be applied in cases of unusual fermentations, two of which were found by the authors in an examination of the 19 samples.

The refractometric determination of milk fat, F. LÖWE (*Milchw. Zentbl., 2 (1906), No. 9, pp. 414–416*).—Scales have been constructed for the Wollny and Abbe refractometers whereby the percentages of fat may be read directly.

A modification of the salt method, RUSCHE (*Molk. Ztg., 20 (1906), No. 38, pp. 1075–1077*).—In preliminary experiments the author obtained good results by reducing the amount of salt required in the Gerber alkali method from 240 to 120 gm. per liter and increasing the amount of alcohol from 0.6 to 1 cc. This modification is believed to lessen the danger of saponifying the fat.

The determination of acidity in cream, HESSE-GÜSTROW (*Milchw. Zentbl., 2 (1906), No. 9, pp. 418, 419*).—In determining acidity by the Thörner method, it is considered necessary to weigh 10 gm. of cream rather than to measure 10 cc. with a pipette.

On the determination of fat in cheese, M. WEIBULL (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 12, pp. 736–738*).—Comparative tests of the extraction, hydrochloric acid, and Gottlieb methods were considered as showing the superiority of the last-mentioned method for this purpose.

Investigations on the determination of soluble and insoluble volatile fatty acids, J. DELAITE and J. LEGRAND (*Bul. Soc. Chim. Belg., 20 (1906), No. 7, pp. 230–235*).—The Reichert-Meissl number was found to increase from 30.03 when saponification was completed in $\frac{1}{4}$ hour to 46.53 when the period of saponification was prolonged to from 5 to 6 hours. This increase is considered due to depolymerization. Saponification for $\frac{1}{2}$ hour is recommended.

Saponification with glycerin and soda was compared with the usual method of saponification with alcohol and potash. The figures with glycerin were regularly 3 to 4 lower, and this method is therefore considered unsatisfactory.

On the use of chromed hide powder in the determination of tannin, E. Nihoul (*Bul. Soc. Chim. Belg., 20 (1906), No. 7, pp. 236–240*).—Comparative tests of hide powders containing from 0.6 to 5 per cent of chromium oxid are reported. The author gives preference to the use of powders only feebly charged with chromium.

Examination of some Western Australian barks, E. A. Mann and R. E. Cowles (*Jour. Soc. Chem. Indus., 25 (1906), No. 17, pp. 831, 832*).—Determinations were made of the percentages of tannin in the barks of a number of common trees in Western Australia with the following results: *Acacia decurrens*, 15.1 per cent; *Eucalyptus salmonophloia*, 16.9, 19.8, and 12.25 per cent; *E. loxiphleba*, 10.6 per cent; *E. longicornis*, 8.73 per cent; *E. redunca*, 12.5 per cent; *E. occidentalis*, 34.57, 39.3, and 44.5 per cent; and *E. cornuta* 10.1 per cent.

[Chemical work for the agricultural department of Western Australia], E. A. Mann (*West. Aust. Govt. Lab. Bul. 3, pp. 25–31, pls. 4*).—The separation and study of poisonous principles in various plants, including especially poison bush (*Gastrolobium calycinum* and *Oxylobium parviflorum*), *Indigofera boviperda*, and darnel or drake (*Lolium temulentum*), which have proven injurious to stock, are briefly reported, as well as comparisons of total and available phosphoric acid and potash in certain typical soils of Western Australia, analyses of various lime and guano deposits, analyses of soil from a white ant hill showing an increase of total and available fertilizing constituents over surrounding soil, and miscellaneous analyses.

Practical methods for identifying and estimating boric acid together with rules for detecting forbidden preservatives, J. Prescher (*Die praktischen Methoden der Bestimmung und des Nachweises der Borsäure, nebst Anweisung zur Untersuchung auf verbotene Konservierungsmittel. Lübeck: Charles Coleman, 1906, pp. 56, illus.; rev. in Österr. Chem. Ztg., 9 (1906), No. 17, p. 240*).—The directions which are given correspond to the law regarding the examination of meat, passed in 1900.

Pure food, drug, and paint law, E. F. Ladd (*North Dakota Sta. Spec. Bul. 4, pp. 18*).—The State pure-food law as amended and reenacted and the pure-drug law and the paint law are given.

Pure food, pure drug, formaldehyde, Paris green, and paint laws, E. F. Ladd (*North Dakota Sta. Spec. Bul. 3, pp. 22*).—This gives the essential features of each law with rulings and interpretations for the guidance of interested parties.

METEOROLOGY—WATER.

Monthly Weather Review (*Mo. Weather Rev., 34 (1906), Nos. 5, pp. 201–253, figs. 13, charts 15; 6, pp. 255–305, figs. 24, charts 6*).—In addition to the usual reports on forecasts, warnings, weather and crop conditions, meteorological tables and charts for the months of May and June, 1906, monthly review of the progress of climatology throughout the world, recent papers bearing on meteorology, recent additions to the Weather Bureau Library, etc., these numbers contain the following articles and notes:

No. 5.—Present Day Climates in Their Time Relation, by F. M. Ball (see p. 312); Relations Between Velocities of Progression of Lows and the Areas of Rising and Falling Pressure Accompanying Them (illus.), by S. Hanzlik; Glaisher's Factors and Ferrel's Psychrometric Formula (illus.), by C. F. Marvin; Improvements in Seismographs with Mechanical Registration (illus.),

by C. F. Marvin; Weather Bureau Men as Educators; Educational Notes; A Destructive Local Storm Near Paris, Ill., by E. O. Laughlin; The Kodaikánal Solar Physics Observatory (illus.), by H. H. Kimball; Hawaiian Mountain Records; The Photoelectric Properties of Selenium Cells (illus.), by K. E. Guthe; West Indian Chart; Phenological Study; Meteorological Work in China, by C. F. Talman; Abnormal April Temperatures in New South Wales, by H. A. Hunt; Severe Hailstorm in the Gulf of Mexico, by R. G. Bindley; The Seiche and Its Mechanical Explanation; Meteorology in German Universities; Observations of "Shadow Bands" Without an Eclipse; Tornado in Australia; and Meteorological Institute of Saxony.

No. 6.—The Mount Rose Weather Observatory (illus.), by J. E. Church, jr.; Use of the Lantern in Teaching Meteorology, by J. P. Goode; Studies on the Thermodynamics of the Atmosphere—IV, Numerical Computations in the Vertical Ordinate, by F. H. Bigelow; The Waterspout Near Tarrytown, N. Y., July 16, 1904 (illus.), by M. L. Bacon; The Tornado of June 6, 1906, near La Crosse, Wis., by G. A. Oberholzer; Weighting Forecasts; The Tornado of April 12, 1906, at Stafford, Kans. (illus.), by W. E. Seright; The Structure of Hailstones (illus.), by D. S. Landis; Suggestions to Observers of Hailstones; Weather Bureau Men as Educators; Lantern Slides for Lectures; Meteorology in Australia; The Energy of a Storm, by T. D. Smith; and Aero Clubs and Meteorology.

Meteorology, P. Boname (*Rap. An. Sta. Agron. Mauritius, 1905, pp. 1–10*).—Observations on atmospheric pressure, temperature, precipitation, humidity, and evaporation in Mauritius during 1905 are summarized.

A marked fall of barometer preceding tornadoes which passed over or near the island is recorded. The year was unusually wet, the mean annual humidity being 88.4, the rainfall 2,410.2 mm., 50 per cent higher than for the previous year. The number of rainy days was 326 and the annual evaporation 376.2 mm.

Meteorological observations for the year 1905 at the Ploti Agricultural Experiment Station, M. Svolinsky (*Ghodīchnuiĭ Otchet Ploty. Selsk. Khoz. Opuitn. Stantziĭ, 11 (1905), pp. 1–24, 121–124*).—As in previous years, observations are reported on atmospheric precipitation, snow cover, evaporation, humidity of the air, temperature of the air and soil, sunshine, solar radiation, atmospheric pressure, and winds, with some description of the self-registering apparatus used. The characteristic features of the season 1905 were a marked deficiency of rainfall, especially during the summer, high temperatures of the air and soil, and increased sunshine.

Some facts about the weather, W. Marriott (*London: Edward Stanford, 1906, pp. 32; rev. in Nature* [*London*], *74 (1906), No. 1917, p. 295*).—A popular discussion of the subject especially adapted to the British Isles.

Weather forecasting from synoptic charts, A. J. Henry (*Jour. Franklin Inst., 162 (1906), No. 4, pp. 297–316, figs. 6*).—This method, based upon two well established facts, namely, (1) the general eastward drift of the atmosphere in temperate latitudes of the Northern Hemisphere, and (2) the close relation between the weather and the distribution of atmospheric pressure, is described and the gain in accuracy, length, and usefulness of weather forecasts is discussed.

The recently organized weather service for North Germany, R. Börnstein (*Mitt. Deut. Landw. Gesell., 21 (1906), No. 31, pp. 313, 314*).—This service is briefly described.

Cannonading against hail, Tabard (*Ann. Soc. Agr. Sci. et Indus. Lyon, 1905, pp. 43–65, figs. 3*).—This article discusses quite fully the history and present status of hail protection in France by cannonading, describing and discuss-

ing the theory of various forms of ordnance for this purpose, particularly the different forms of acetylene cannon first introduced by Maggiora Graziani, of Italy. The advantages of this system are quite fully explained.

Studies of the annual precipitation of the Continent of Africa, G. Fraunberger (*Mitt. Justus Perthes' Geogr. Anst., 52 (1906), No. 4, pp. 73–82, map 1*).—The available data on this subject are compiled, and a colored map showing the geographical distribution of rainfall is given, with discussions of the general rainfall characteristics of the continent and of different typical districts as follows: Eastern Sahara, Guinea coast region and hinterland, Congo and Orange, east side of longitude 25° and British East Africa, Somaliland, Abyssinia, Egyptian Sudan, and Egypt.

Climatology of South Africa (*Quart. Jour. Roy. Met. Soc. [London], 32 (1906), No. 139, pp. 239, 240*).—This is an abstract of a paper by C. Stewart before the British Association at its Cape Town meeting, summarizing quite fully the climatological conditions of South Africa, based upon the observations of a considerable number of stations scattered over the region.

The chief factors controlling the climate are stated to be ocean currents and elevation. A remarkable feature is the great uniformity in mean annual temperature, this being about 62° throughout the region. "This is due to decrease of temperature with increase of elevation above sea-level, almost neutralizing the increase of temperature which would otherwise occur with increased intensity of solar radiation due to a nearer approach to the equator."

The temperature of the coastal regions varies with relation to the ocean currents. South Africa is divided into three rainfall areas "(1) winter rainfall area in the west, (2) constant rains (small area) in south, and (3) summer rains in the east." There was little evidence in support of the "south-east rain" theory, especially for the coastal areas. In the cape peninsula the largest amount of sunshine occurs in summer; in the plateau regions in winter.

Present day climates in their time relation, F. M. Ball (*Mo. Weather Rev., 34 (1906), No. 5, pp. 201–205*).—A brief review of some of the more important facts regarding climatic changes with special reference to geological changes.

It is stated that while we must conclude from all the scientific data available that all climates remain invariable, "the most elementary knowledge of geology and related earth sciences is sufficient to prove that climates have changed many times in the geologic ages through which the earth has passed. All theories accounting for such changes lead irresistibly to the conclusion that climates to-day must be changing, although not in any measurable amount."

Cold waves and frost in the United States, E. B. Garriott (*U. S. Dept. Agr., Weather Bur. Bul. P, pp. 22, charts 328*).—"The paper notes briefly the general distribution of the colder areas of the Northern Hemisphere, refers to general conditions that are associated with cold waves, and presents a chronological account of historical cold periods in the United States. It then summarizes and classifies the more important cold waves and frosts that occurred from 1888 to 1902, inclusive, and presents 328 charts that exhibit the meteorological conditions that attended the principal cold waves of that period."

The thermal anomalies on the earth's surface, F. Hopfner (*Mitt. Justus Perthes' Geogr. Anst., 52 (1906), No. 2, pp. 32–36, chart 1*).—New normal monthly and annual isothermal lines for the different hemispheres similar to those of Dove[a] are calculated and charted to show thermal anomalies and

[a] Die Verteilung der Wärme auf der Oberfläche der Erde (Berlin, 1852).

their probable causes. The possible sources of error in such work are discussed.

Annual variations in the temperature of the earth's surface (*Mitt. Justus Perthes' Geogr. Anst., 52 (1906), No. 2, p. 37, fig. 1*).—Isothermal lines based upon data given in Hopfner's article above referred to are charted. These show directly the dependence of temperature upon the distance from the poles and indirectly its dependence upon the distribution of land and water.

An apparent periodicity in the yield of wheat for Eastern England, 1885 to 1905, W. N. Shaw (*Proc. Roy. Soc.* [*London*], *Ser. A, 78 (1906), No. A521, pp. 69–76, fig. 1*).—An account of a continuation of studies which have been briefly reported elsewhere (E. S. R., 16, p. 955).

As a general conclusion from these further studies confined to Eastern England it is stated that "a relation between the autumn rainfall and the wheat crop is sufficiently manifest, but evidently the fall of rain is subject to disturbances of an irregular character which have little counterpart in the curve of wheat values."

The law of sequence in the yield of wheat for Eastern England, 1885–1904, W. N. Shaw (*Met. Ztschr., 1906,* [*Hann-Band*], *pp. 208–216, figs. 2*).—A discussion is here given of comparative observations already noted from another source (see above).

The results of 20 years' observations for Eastern England indicate a somewhat different relation of crop and rainfall from that indicated by the observations for the whole of England, being as follows: Wheat yield =46 bu. −2.2 times the preceding autumn rainfall, and this relation held quite closely for 13 of the 20 years. The other 7 years, however, were somewhat anomalous and the rainfall-yield relationship did not hold. A closer examination of data for these years indicated an 11 year periodic fluctuation of yield made up of component harmonic periodic fluctuations having a common nodal point in the interval 1895–96, in which there was a reversal of the yield curve. In a later publication (see note below) the author compares the actual yields of wheat during 21 years, 1885–1905, with that computed from component curves having the following amplitudes:

Period (years)	11	$\frac{11}{2}$	$\frac{11}{3}$	$\frac{11}{4}$	$\frac{11}{5}$	$\frac{11}{6}$
Amplitude (bushels)	+2.9	−0.5	−1.8	+2.8	+1	+1

The calculated and actual results show a remarkably close agreement throughout the period. The relationships here indicated apparently furnish a means of predicting the yield of future years. The yield thus predicted for 1905 was 31.9 bu., while the actual returns showed 32 bu.

Report of the meteorlogical committee, Great Britain (*Rpt. Met. Com.* [*Gt. Brit.*], *1906, pp. 154, pls. 5, fig. 1; abs. in Nature* [*London*], *74 (1906), No. 1923, p. 477*).—This consists as usual of administrative reports regarding organization and operations (during the year ended March 31, 1906) in marine meteorology, forecasts and storm warnings, climatology, publication, and miscellaneous subjects, with appendixes relating to the supply of information to the public, lists of logs and other documents received during the year, distribution of instruments, reports on inspections of meteorological stations, list of persons and institutions from whom publications are received, list of persons and institutions to whom publications are sent, and financial statement.

Among the more important researches begun or completed during the year are "(1) the study of the trajectories of air in traveling storms, embodied in an official publication entitled 'The Life-history of Surface Air Currents;' (2) redetermination of the velocity equivalents of the Beaufort scale of wind

force; (3) connection between the yield of wheat in eastern England and the rainfall of the previous autumn (see p. 313), and (4) possible relationship between exceptional strength of the southeast trade wind at St. Helena and exceptional rainfall in England."

The percentage of complete or partial success of special harvest forecasts was 89; of the regular forecasts for the whole of the British Isles, 88. The number of storm-warning telegrams justified by subsequent gales or strong winds was 88.4 per cent.

The work of the chemical laboratory of the Ploti Agricultural Experiment Station in 1905, B. M. WELBEL (*Ghodĭehnuĭ Otchet Ploty. Selsk. Khoz. Opuitn. Stantziĭ, 11 (1905), pp. 73–119, 128–135*).—Analyses of atmospheric precipitation and drainage waters from lysimeters and of crops and soils used in pot experiments, with reference especially to content of nitrogen in different forms, are reported as in previous years, with discussion of the distribution of the nitrogen compounds and the nitrogen balance in the soil. The results obtained were very similar to those of previous years. The pot experiments showed that forage plants exert an individual influence on the rate of nitrification, esparcet being superior in this respect to alfalfa.

The experiments with barnyard manure, which were continued during the year as in previous years, show that the effect of the manure does not extend beyond 3 years and is shown mainly in an increase in nitric nitrogen and assimilable phosphoric acid in the soil.

The value of pure water, G. C. WHIPPLE (*Engin. Rec., 54 (1906), Nos. 10, pp. 269–272, fig. 1; 11, pp. 303–305*).—The contents of this paper are briefly summarized in part as follows:

"(1) Pure water as compared with impure water has a real financial value to a community. (2) This value may be measured by determining what impure water costs the community. (3) There are three principal characteristics which affect the value of water to the general consumer—its sanitary quality, its attractiveness, and its hardness. (4) A formula is suggested for computing the effect of the sanitary quality of water on its financial value to a community; it is based on the typhoid fever death rate. (5) A formula is suggested for computing the effect of the general attractiveness of water on its value to consumers; it is based on the physical characteristics of turbidity, color, and odor. (6) A formula is suggested for computing the effect of the hardness of water on its value to the consumers; it is based on the use of soap in the household. (7) Considered from the financial aspect alone, and disregarding all humanitarian considerations, the filtration of a polluted water supply adds very greatly to the vital assets of a community; hence, as a mere business proposition, no city can afford to allow an impure water supply to be publicly distributed. (8) The advantages to a community of having a water supply not only safe, but also attractive in appearance, taste, and odor, are material from a financial aspect; the increased value of many waters because of the improvement in their esthetic qualities alone justifies the cost of filtration. (9) Water-softening at present does not receive the attention it deserves at the hands of municipal authorities; the economic advantages to be gained by removing the hardness of water are so great that, in many cases, the saving to the ordinary water consumers justifies the cost of softening water."

Quality of water in the Upper Ohio River basin and at Erie, Penn., S. J. LEWIS (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 161, pp. 114, pls. 6, figs. 3*).—"This paper discusses the quality of water on the most important tributaries of the Ohio River in Pennsylvania, New York, West Virginia, and Maryland, and the nature of the water supply at Erie, Penn. The amount and

character of the pollution is described and the results of drinking contaminated water as shown by typhoid statistics are indicated."

Summary of the underground-water resources of Mississippi, A. F. Crider and L. C. Johnson (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 159, pp. VI+86, pls. 6, figs. 11*).—This bulletin gives a detailed account of observations on the topography, general geology, and underground-water resources of the State, including under the latter head notes on wells in different counties of the State, deep well records, and sanitary aspect of wells. (See also E. S. R., 17, p. 640.)

"In the Gulf Coastal Plain, of which Mississippi is a part, conditions are favorable for reducing to a minimum the death rate caused by drinking impure and unwholesome water. A study of the geologic conditions of the State shows that there is a great thickness of unconsolidated sands interbedded with water-tight clays which dip slightly to the south and west and form large underground reservoirs for the accumulation of water. The State has a heavy annual rainfall, which enters the upturned edges of the open-textured sands, collects in these wide reservoirs, and thus becomes available as well water when the overlying strata are drilled through. Good deep-well water can be obtained over almost the entire State, and there are large areas in which under favorable conditions flowing wells are obtained. The dip of the strata is so regular and the water horizons are so numerous that the areas are small in which potable water can not be found at comparatively shallow depths.

"In most of the localities having flowing wells the supply seems adequate for all demands so far made upon it. The low cost of drilling wells in the Gulf embayment has made it possible for even the poorest to have plenty of good water. Railroads, cotton mills, sawmills, canning factories, and various public works have found the deep-well water cheaper and better than surficial water. Along the southern coast in the rice area water for irrigation is in many places obtained from artesian wells."

The advantages of driven, bored, or drilled wells over open wells are quite fully explained.

Underground water papers, M. L. Fuller (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 160, pp. 104, pl. 1, figs. 4*).—A number of short papers by different authors dealing with questions relating to the occurrence, distribution, amount, contamination, peculiarities, and methods of study of underground waters.

Bibliographic review and index of underground-water literature published in the United States in 1905, M. L. Fuller, F. G. Clapp, and B. L. Johnson (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 163, pp. 130*).—A bibliography of 721 titles, with an alphabetical index of subjects, is given.

Destructive floods in the United States in 1905, E. C. Murphy et al. (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 162, pp. V + 105, pls. 4, figs. 11*).—Data are given for 19 floods occurring in the United States during the year, with notes on damage caused in some cases and possible means of prevention or control. The bulletin also contains a discussion of flood discharge and frequency and an index to flood literature in the United States.

SOILS—FERTILIZERS.

Soils, E. W. Hilgard (*New York and London: The Macmillan Co., 1906, pp. XXVII + 593, figs. 90*).—This volume embodies the matured fruits of a long and varied experience, generally under pioneer conditions, in both humid and arid regions. Its conclusions are of especial value because they are based to

so large an extent upon studies of soils in their natural condition and in which cultural adaptations have not been obscured by long years of artificial treatment. In the author's opinion the advance of knowledge of soils has been retarded by the fact that investigations in this field have dealt mainly with more or less artificial soils—that is, soils which have long been under cultivation and whose natural relations to vegetation have thus been obscured.

The book "includes the discussion both of the methods and results of direct physical, chemical, and botanical soil investigation, as well as the subject-matter relating to the origin, formation, classification, and physical as well as chemical nature of soil, usually included in works on scientific agriculture.

"In the presentation of these subjects, it has been the writer's aim to reach both the students in his own classes and in the agricultural colleges generally, as well as the fast increasing class of farmers of both regions who are willing and even anxious to avail themselves of the results and principles of scientific investigation, without 'shying off' from the new or unfamiliar words necessary to embody new ideas. . . . But in order to segregate to some extent the generally intelligible matter from that which requires more scientific preparation than can now be generally expected, it has been thought best to use in the text two kinds of type; the larger one embodying the matter presumed to be interesting and intelligible to the general reader, while the smaller type carries the illustrative detail and discussion which will be sought chiefly by the student.

"As regards the chemical nomenclature used in this volume, the writer has not thought it advisable to follow the example set by some late authors in substituting for the well-known names of the bases and acids, those of the elements, and still less, those of the intangible ions. . . .

"Inasmuch as all the elements are presented to and contained in the plant in compounds only, and these compounds are themselves, in the dilute solutions used by plants, known to be largely dissociated into their basic and acid groups, it seems to be most natural to present them under the corresponding, even if not absolutely theoretically correct names of acids and bases, to which the farmer and the trade have been accustomed for half a century. Upon these considerations the long-used designations of potash, soda, lime, phosphoric, sulphuric, nitric, and other acids and bases have been retained in this volume, adding the chemical formula where, as in analytical statements, a doubt as to their meaning might arise."

The make-up of the book is indicated by the following summary of its contents: An introduction and 5 chapters devoted to origin and formation of soils, 12 chapters to physics of soils, 6 chapters to chemistry of soils, and 3 chapters to soils and native vegetation.

The soil and its cultivation, P. Diffloth (*Le sol et les labours. Paris: J. B. Baillière & Son, 1906, pp. 490, figs. 144; rev. in Mois Sci., 8 (1906), No. 4, p. 15; Nature* [*London*], *74 (1906), No. 1905, p. 4*).—This is one of the series of volumes constituting the *Encyclopédie agricole*, edited by G. Wéry.

The volume treats of the origin, properties, composition, analysis, and cultivation of soils, and is divided into two main parts, agrology and preparation of the soil. Under the general head of agrology are discussed the relation of land to agriculture and the general rules and principles which govern the relations between the nature of the soil and the products which it yields. The second part treats of the various operations of clearing, cultivating, and improving land. The soil is considered in its threefold relation of mechanical support, reserve material, and medium, and recent discoveries regarding the relation of the soil to the nutrition of plants are embodied in the work.

Methods of physical, mechanical, geological, and chemical analysis of soils are briefly described.

Soil survey field book (*U. S. Dept. Agr., Bur. Soils, Soil Survey Field Book, 1906, pp. 319, fig. 1*).—This is a revision of Instructions to Field Parties and Description of Soil Types, published in 1904, in which an attempt has been made to correlate the soils of the United States in the light of the additional information which has been obtained from soil surveys since that time, only such changes being made as were considered necessary to bring each soil into its proper place in the classification.

The book contains directions for surveying soils; classification of soils according to type, class, and series; instructions for estimating and mapping alkali; methods of determining total salts in water; instructions for the qualitative determination of alkali salts; instructions regarding the collection of laboratory samples and the preparation of reports; descriptions of established soil types; indexes of soil types arranged alphabetically by crops and series and by States; and an alphabetical list giving number and page of soil survey reports in which the different descriptions of soils are found.

Alkali soils of the United States, C. W. Dorsey (*U. S. Dept. Agr., Bur. Soils Bul. 35, pp. 196, figs. 13*).—This is a review of literature and summary of present information, dealing with the alkali content of arid soils, comparison of soils of arid and humid regions, origin of alkali, kinds of alkali, accumulation of alkali in the soil, and resistance of plants to alkali, with a résumé of the work of agricultural experiment stations on alkali soils, and the soil and alkali surveys in the irrigated districts, laboratory investigations, and reclamation experiments by the Bureau of Soils.

Analyses of soils, C. F. Juritz (*Rpt. Senior Anal. Cape Good Hope, 1905, pp. 31, 32*).—Percentage of fine earth passing ½-mm. mesh sieve and partial chemical analyses of soil passing 1-mm. and ½-mm. mesh sieves are reported (water, organic matter, chlorin, and nitrogen in the first case and lime, potash, and phosphoric acid in the second) for 47 samples of soil from different parts of the Cape of Good Hope.

On certain physical properties of sands and the method of their determination, E. J. Köhler (*Über einige physikalische Eigenschaften des Sandes und die Methoden zu deren Bestimmung. Nuremberg: U. E. Sebald, 1906, pp. 85, pl. 1, figs. 5*).—This thesis discusses and gives the results of studies of those properties of sand—size and shape of particles, porosity, relation to movement of water, etc.—which are of special importance to the engineer. The results, however, are also of importance from the standpoint of the physics of soil moisture.

A list of references to the literature of the subject is given.

Contributions to our knowledge of the composition of humus, E. J. Michelet (*Arch. Math. og Naturvidensk., 27, No. 7, pp. 18*).—Ten samples of decayed wood, lake mud, or cultivated soils were examined for their contents of water, ash, organic substances, nitrogen, carbon, hydrogen, pentosans, methyl pentosans, methoxyl number, the object in view being to ascertain the variations in the pentosan contents of natural humus substances and the relation between the methyl pentosans and the pentosans, as well as to examine whether the presence of methyl groups combined with oxygen ($O-CH_3$) in the humus could be proved by the so-called methoxyl number.—F. W. WOLL.

The influence of long-continued rains on the impoverishment of soils, L. Grandeau (*Jour. Agr. Prat., n. ser., 11 (1906), No. 17, pp. 521, 522*).—This deals especially with the influence of long-continued rains in checking nitrifi-

cation and washing nitrates from the soil. The loss of potash and phosphoric acid from this cause is inconsiderable.

The erosion of soil, or washing away of our farms, S. W. WARFIELD (*Bien. Rpt. Tenn. Dept. Agr., 1903–4, pp. 115–120*).—A brief discussion of this subject, showing its great importance to the farmers in middle and east Tennessee.

Preservation and improvement of soils, R. GALLAGHER (*Bien. Rpt. Tenn. Dept. Agr., 1903–4, pp. 120–124*).—A brief general discussion of this subject, including a description of a system of cultivation and rotation which the author has found effective in restoring the humus content of the soil and bringing back "unproductive and unsightly fields from barrenness to the production of paying crops." The rotation proposed is peas (for hay), rye, peas, wheat, fallow with manure, corn, wheat, clover.

Soil moisture, G. BURNS (*Yearbook Khediv. Agr. Soc., Cairo, 1905, pp. 265–272*).—A general discussion of this subject with special reference to Egyptian conditions is given and experiments to test the effect of surface cultivation to conserve soil moisture are reported. Surface cultivation in general reduced the loss of water, but shallow cultivation (hoeing) proved better than deep cultivation during the hot summer months.

The moisture conditions of a loam soil under various crops, C. VON SEELHORST (*Jour. Landw., 54 (1906), No. 2, pp. 187–206, pls. 3; abs. in Chem. Ztg., 30 (1906), No. 62, Repert. No. 25, p. 255*).—Data for yields and moisture content of soils in case of field experiments during 3 years with potatoes, wheat, rye, oats, beets, peas, and clover are reported and discussed. It was observed that rye exhausted the soil moisture less than wheat. The exhaustion was especially marked in case of clover and oats and was very small in case of potatoes and peas. The application of the results in deciding upon the best rotation to conserve soil moisture is indicated.

Investigations of the hygroscopicity of some typical Swedish soils, G. NANNES (*K. Landtbr. Akad. Handl. och Tidskr., 44 (1905), No. 6, pp. 382–386*).—Determinations of the hygroscopicity of soils were made by drying 5 gm. of the air-dry sample for 5 to 6 days over 10 per cent sulphuric acid in a desiccator in partial vacuum at ordinary room temperature. The weight being constant after this period the residual water was determined in the humus soils according to Arntz's method by drying in a dry current of air at 105° C., and in the other kinds of soil, in a drying oven at the temperatures for the respective soil types given by Rodewald and Mitscherlich. The results of the investigations of soils in Skaraborg County, Sweden, made by the author indicate that the hygroscopicity per cent of sandy, sandy loam, and peat soils ought not to be less than half the amount of organic substance which they contain, while that of clay soils ought not to go appreciably below the content of organic substance, and should be higher, the more fertile the soil is.—F. W. WOLL.

Measurements of soil temperatures at Norwegian stations, 1903–4, G. HOLTSMARK and A. K. ANDERSEN (*Norges Landbr. Höiskoles Skr., 1905, No. 8, pp. 22*).—This is a continuation of previous observations, with average data for Aas station for 1896–1904, and for the stations at Jönsberg, Rotvold, Bodö, and Stend for the period 1900–1904. The following average annual figures will prove of interest. The latitude, longitude east of Greenwich, and altitude of the different stations are as follows: Jönsberg, 60° 45′, 11° 12′, 200 meters; Rotvold, 63° 26′, 10° 29′, 24 meters; Bodö, 67° 16′, 14° 26′, 15 meters; Stend, 60° 16′, 5° 20′, 48 meters.

Average annual soil temperatures for Norwegian stations.

Name of station.	Period.	Air temperature.	Temperature of soil at— One-fourth meter.	One-half meter.	One meter.	One and one-half meters.
Aas	1896–1904	4.28	5.67	5.74	5.97	6.13
Jönsberg	1900–1904	1.54	3.38	4.06	4.37	....
Rotvold	1900–1904	....	4.33	4.59	4.97	....
Bodö	1900–1904	3.20	3.43	3.72	4.02	....
Stend	1900–1904	5.16	6.01	6.42	6.54	....

—F. W. WOLL.

The solvent action of roots upon the soil particles, A. D. HALL (*Sci. Prog. Twentieth Cent., 1 (1906), No. 1, pp. 51–57*).—The author reviews the literature of this subject, reaching the conclusion "that it is not necessary to assume the existence of an excretion from the roots of the plant of a permanent acid, organic or inorganic, to attack the solid mineral particles of the soil and to bring them into solution for the nutrition of the plant. The growing portions of a plant root are always giving off carbon dioxid, and carbon dioxid, especially in the concentrated solution which must be momentarily formed in the cell wall of the root hairs, has an appreciable solvent effect upon the majority of the minerals composing the soil. This carbon dioxid alone is capable of giving rise to such solutions as are required for the nutrition of the plant. As the direct evidence is also adverse to the idea of an excretion of acid, the principle of not seeking remote causes would lead us to attribute to carbon dioxid, and to carbon dioxid only, the long-recognized solvent power of the plant upon the soil."

The fallow in modern agriculture, S. RHODIN (*K. Landtbr. Akad. Handl. och Tidskr., 45 (1906), No. 1, pp. 57–72, fig. 1*).—The evidence and views in regard to the value of bare fallow, especially in Swedish agriculture, are briefly discussed. While bare fallow of loose sandy soils is not to be recommended, because the losses of nitrogenous substances occurring, generally speaking, exceed the gains through nitrification, this is not the case with other types of soils. Here an accumulation of nitrates takes place through the fallow, which greatly benefits the following grain crop.

Field experiments with cabbages in 1903 and with potatoes in 1904 and 1905 were conducted for the purpose of determining whether inoculation of sandy soils with fallow soil would prove beneficial on account of the large bacterial content of the latter. The systems of fertilization followed are shown below, the different plats receiving as a basal fertilizer 37 per cent potash salt and Thomas phosphate, at the rate of 225 and 400 lbs. per acre, respectively. The nitrate of soda was applied at the rate of 300 lbs. per hectare (267 lbs. per acre) and the inoculated soil at the rate of 6 cubic meters per hectare.

Yields per acre and percentage increase of crops on inoculated and uninoculated gravelly soil.

	Cabbages, 1903.		Potatoes, 1904.		Potatoes, 1905.	
	Pounds.	*Per cent.*	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*
No fertilizer	8,906.88	36	6,791.49	39	9,908.90	62
Potassium phosphate	24,582.99	100	17,368.42	100	15,809.72	100
Potassium phosphate + soil from bean field	24,939.27	101	20,819.84	120	20,485.83	130
Potassium phosphate + soil from fallow field	33,222.67	135	23,046.56	132	18,370.44	116
Potassium phosphate + nitrate of soda	60,834.00	250	30,172.06	173	23,046.56	145

The author calls attention to the fact that a marked after-effect of the nitrate of soda is noticeable, even as late as two years from its application; there is an increase in the subsequent crops grown on the nitrate plats, as previously called attention to by Maercker, Wagner, and Weitz: the explanation given by Wagner is that the nitrate is changed by the calcium carbonate in the soil into sodium carbonate, which occludes the soil particles and increases the water-retaining power of the soil, and thereby also the subsequent crops grown on the land.—F. W. WOLL.

Recent contributions to our knowledge of moor land culture, H. VON FEILITZEN (*K. Landtbr. Akad. Handl. och Tidskr., 44 (1905), No. 6, pp. 369–381*).—A general résumé of recent research work on moor soils.

Culture trials of the Swedish Moor Culture Society at Jönköping and Flahult, H. VON FEILITZEN (*Svenska Mosskulturför. Tidskr., 20 (1906), No. 3, pp. 193–219, figs. 2*).—Among the trials described in this report the following may be mentioned: Trials with liming and applications of sand, white moss or peat soil (*dyjord*) on moor soils; fertilizer trials with 37 per cent potash salt and mineral fertilizer (ground feldspar); with different potash salts, phosphates, and nitrogenous fertilizers, with lime niter, nitrate of soda for pasture land and for winter rye on sanded white-moss soils.—F. W. WOLL.

Plant culture and fertilizer trials in Northern Norway (Tromsö Stift), B. R. LARSEN (*Tidsskr. Norske Landbr., 12 (1905), No. 9, pp. 389–398*).—The article gives a brief account of trials with potatoes, turnips, and other root crops, and of a few fertilizer trials conducted in this northern region. In several subsequent issues of the *Tidsskrift* various phases of agriculture in this region are further discussed by different writers.—F. W. WOLL.

Results of vegetation experiments in the years 1901–1903, D. N. PRIANISHNIKOV (*Izv. Moscov. Selsk. Khoz. Inst. (Ann. Inst. Agron. Moscou), 11 (1905), No. 2–3, pp. 155–219*).—The present article is a report for the sixth, seventh, and eighth years of the culture experiments. The following are the general conclusions of the author:

(1) By the introduction of ammonium salts in sand cultures the conditions of the assimilation of phosphoric acid are essentially changed, even the difficultly soluble phosphates becoming available for all the plants. This influence may ordinarily be caused by nitrification, but it may also result from the physiological acidity of such salts as ammonium sulphate. It is obvious that in the nitrification of the latter two acids—nitric acid formed from the base and sulphuric acid—must be neutralized. Ammonium nitrate of all the sources of nitrogen appears to be most favorable for the maintaining of the nutrient solutions in the neutral state; but even this salt can not be used when the availability of the various phosphates is tested, since it may undergo nitrification and may also become physiologically active.

(2) Ash washed with water (to remove potassium carbonate) contains the phosphoric acid in a highly assimilable form; the development of plants provided only with this source of phosphoric acid is not only equal to that of "normal cultures," but frequently surpasses it; this once more proves that the so-called normal cultures elaborated by Knop, Hellriegel, and others do not have the ideal composition.

(3) As in previous experiments, phosphoric acid in the form of bone meal proved in sand cultures to be fairly available, the yields with bone meal being in most cases not lower than 60 per cent of those obtained with soluble phosphates. If, however, calcium carbonate or ferric hydrate were added the yields with bone meal were considerably lower.

(4) The sand cultures with phosphorites of different origin seem to warrant the conclusion that the variations in the solvent power of different plants

may be more important than the varying properties of the phosphates. Lupines, for example, can show, with an apatite like phosphorite, a considerable development not inferior to that with amorphous phosphorites, while the Gramineæ give with any phosphorite an extremely poor yield. In field cultures, however, the influence of the soil seems to predominate over everything else.

(5) Iron and aluminum phosphates are not to be considered as unavailable to the plants.

(6) As Votchal has also shown, potash mica proved in these experiments to be a considerably better source of potash than orthoclase.

(7) The data of the sand and water culture experiments regarding the importance of chlorin for plants do not corroborate the generally accepted opinion of the usefulness of chlorin as such for plant life. Of more importance, probably, is its influence on the physiological reaction of the culture media.

(8) The liming experiments lead to the following conclusion: While it is true that the optimum amount of lime introduced depends not only on the properties of the soil, but also on those of the plant, it seems to be beyond a doubt that the influence of the soil is much stronger than that of the plant; thus the lupine, which is considered a calcifugous plant, tolerated on a chernozem soil larger quantities of lime (1 per cent of the total weight of the soil) than oats on a marshy clay.—P. FIREMAN.

On the value of soil analyses for ascertaining the fertilizer requirements of soils, M. WEIBULL (*Malmö. Läns K. Hushall. Sällsk. Kvrtlsskr., 1905, No. 3, pp. 592–597*).—The article gives a brief summary of the author's views with regard to the practical value of soil analysis, based largely on the experience gained during several years' field experimentation on Swedish farms, in connection with chemical and mechanical analyses of the soils on which crops were grown. He concludes that determinations of the nitrogen and phosphoric-acid contents of a soil are of no practical value, since all normal soils respond to nitrogenous fertilization, irrespective of their nitrogen content, and no definite relation has been found between the phosphoric-acid content of the soil and the manner in which they respond to applications of this ingredient. As regards potash, three points should be kept in view, the potash content of the soil, its stiffness (content of clay), and the crop to be grown thereon. If a soil contains less than the following average percentages of potash soluble in warm hydrochloric acid (sp. gr. 1.1), it is nearly always benefited by potash fertilizers: Heavy, medium, and light clay soils, 0.25, 0.20, and 0.15 per cent, respectively; clayey sandy and sandy soils, 0.12 per cent. Potatoes, barley, and other crops which need considerable soluble potash call for potash fertilizers when grown on a soil containing as much as or less potash than given; on the other hand, oats under similar conditions will not require potash.

As regards lime, the reaction of the soil is important. Acid soils always require applications of lime, at least sufficient to change their reaction to neutral. Neutral soils as a rule only need lime when their content of assimilable lime is less than 0.25 per cent, or in the case of heavy clay soils, where an addition of quicklime or slaked lime will decrease their stiffness. Alkaline soils do not, generally speaking, need lime, but if very heavy may be improved physically by applications of burnt or slaked lime.—F. W. WOLL.

A contribution to practical soil analysis, M. WEIBULL (*Chem. Ztg., 30 (1906), No. 59, p. 722; abs. in Chem. Centbl., 1906, II, No. 8, p. 703*).—See abstract above.

The relation of sodium to potassium in soil and solution cultures, J. F. BREAZEALE (*Jour. Amer. Chem. Soc., 28 (1906), No. 8, pp. 1013–1025, pl. 1*).—This subject was studied in a series of experiments with wheat and one ex-

periment with radishes by the pot and water-culture methods of the Bureau of Soils of this Department, the plants being grown for 15 to 19 days in solutions or 24 to 32 days in soils containing varying proportions of potash, soda, and other constituents, but of equal concentration, and then being transferred for 2 or 3 days' growth in a full nutrient solution. It was observed that the general development of the plants was in the same relative order as their transpiration. The presence of sodium increased the transpiration and size of plants even when there was an abundance of potash and other mineral constituents in the solution. As a rule, however, the effect of soda in increasing the size of the plant was not marked where no potash was present.

In case of both soil and solution cultures "there was a greater demand for potassium in the plants which had been growing in a [medium] which had received no potassium than in the plants which had always had a sufficient quantity of that element. . . . The absorption of potassium from the solution of the second period was strikingly decreased when sodium was present in the solution of the first period. . . . Plants which for the first period grew in a solution containing sodium but no potassium drew less heavily upon the potassium of the full nutrient solution than the plants which for the first period grew in a solution containing neither sodium nor potassium. There was a greater absorption of potassium where sodium had been absent than where it had been present."

The deficiency of potash resulting from systems of fertilization in Belgium, Verstraete (*Bul. Soc. Chim. Belg., 19 (1905), No. 8–9, p. 267*).—Figures are presented to show that the systems of fertilization practiced during many years past in Belgium have resulted in a decline in total and available potash.

The loss of nitrogen from soils in fertilizing with nitrate of soda, J. Stoklasa, J. Jelínek, and A. Ernest (*Ztschr. Zuckerindus. Böhmen, 30 (1906), No. 5, pp. 223–233; abs. in Chem. Centbl., 1906, I, No. 14, pp. 1181, 1182; Jour. Chem. Soc. [London], 90 (1906), No. 523, II, p. 303*).—Culture tests in Giltay-Aberson solutions with various samples of soils rich in humus and of Bohemian sugar-beet soils are reported, which show that when glucose and salts of citric acid were present there was a considerable loss of nitrogen by denitrification. Other experiments with extracts of the soils inoculated with *Bacterium hartlebi* indicated that the soils were deficient in organic substances which could serve as a source of carbon for denitrifying organisms. The authors therefore conclude that with proper tillage these soils would not lose nitrogen in the free state.

The natural losses of nitrogen from soil and the use of nitrate of soda, L. Grandeau (*Jour. Agr. Prat., n. ser., 11 (1906), No. 18, pp. 553, 554*).—A brief discussion of this subject based upon investigations made at Rothamsted (E. S. R., 17, p. 533).

Nitrification as studied by means of drainage water, J. Hudig (*Cultura, 18 (1906), No. 211, pp. 149–163, fig. 1*).—Studies by Sjollema of the drainage water of 6 plats of land, each 300 square meters in area, during 4 years are reported.

The results show that the loss of nitrogen in the drainage water was very small and practically negligible. Even when nitrogen was applied in the spring in form of ammonium sulphate the losses were not large unless heavy rains occurred at the time. The nitrogen is apparently rapidly taken up by the young growing plants at this season of the year and only a small portion is free to pass into the drainage. The greatest losses occur in the fall, when the soil is bare and heavy rains occur, the nitrates having accumulated in large quantities during the warmer period of the year. Large losses at this season

are, however, prevented by the growing of cover crops. Observations on the same subject by Hall at Rothamsted are also reviewed.

The study of nitrification in soils by means of drainage water investigations (*Mitt. Deut. Landw. Gesell., 21 (1906), No. 18, pp. 195–203, figs. 2*).—This article is based upon reviews of the Rothamsted work by Miller and Hall and Bieler (E. S. R., 8, p. 636; 17, p. 542), and of Sjollema's investigations in Holland by Hudig (see p. 322).

The rôle of organic matter in nitrification, A. Müntz and E. Lainé (*Compt. Rend. Acad. Sci. [Paris], 142 (1906), No. 8, pp. 430–435; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 523, II, p. 298*).—In view of the fact that Winogradsky has shown that organic matter is not necessary to the growth of nitrifying micro-organisms and that there is a general opinion that the presence of organic matter is a disadvantage rather than advantage in the growth of such organisms, the authors undertook to determine the true relation of organic matter to nitrification. With this purpose in view they studied the rate of nitrification in neutral ammonium humate prepared from garden soil and in a solution of sulphate of ammonia containing an equal amount of nitrogen. They also studied the rate of nitrification in natural soils of different kinds, including garden soil, compost, silico-calcareous soil, clay soil, and calcareous clay soil in unsterilized condition, and in two of the soils, one rich and the other poor in humus, after sterilization and subsequent inoculation both with a soil poor in humus and with one rich in humus.

The general conclusions reached in these investigations were that humus even in large quantity does not interfere with nitrification, but, on the other hand, is favorable to it. An abundance of humus is not a necessary condition to nitrification, since soils poor in this constituent gradually develop intensive nitrification. The humus, however, appears to favor the multiplication of the nitrifying organisms, and a soil which contains a large amount of humus is more abundantly supplied with these organisms and more apt to enter into rapid nitrification. The idea that organic matter in the soil interferes with nitrification must therefore be abandoned.

Investigations on intensive nitrification, A. Müntz and E. Lainé (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 22, pp. 861–867; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 520, II, p. 114*).—The possibility of so intensifying nitrification that it may be made a means of supplying nitrates in time of war when outside supplies might be cut off was studied and experiments are reported which indicate that by using solutions containing 7.5 gm. per liter of ammonium sulphate and coarse-grained animal black in layers 2 m. thick, it would be possible at a temperature of 30° C. to produce nitrate at the rate of 5,000,000 to 6,000,000 kg. per hectare per year. With a compost of well-rotted leaves, manure, and soil in a layer 50 cm. deep moistened with a solution of 1 part of ammonium sulphate per 1,000 of water nitrates were produced at a rate of 1,200,000 kg. per hectare annually. A practical difficulty in connection with the method is the very dilute solution of nitrate obtained, requiring a large amount of evaporation, and the dilute solution of ammonium sulphate which must be used. By following methods similar to those employed in the old niter beds the nitrates were concentrated to 27 to 33 gm. per kilogram of soil (2.7 to 3.3 per cent) or over 150 gm. per liter of soil solution. The possibility of further concentration of solutions obtained from oxidation by means of animal black by replacing the ammonium sulphate nitrified and passing the mixture of nitrates and ammonium salts through the beds again is being studied.

Niter and the national defense, A. Müntz (*Ann. Inst. Nat. Agron., 2. ser.,*

4 (1905), No. 2, pp. 219–226).—A discussion of the importance of developing methods of artificial preparation of nitrate of soda, especially by means of intensive nitrification, to replace supplies derived from natural nitrate deposits which are becoming exhausted or might be entirely cut off in time of war.

On a nitrogen assimilating Clostridium, H. PRINGSHEIM (*Centbl. Bakt. [etc.], 2. Abt., 16 (1906), No. 25, pp. 795–800; abs. in Chem. Ztg., 30 (1906), No. 81, Repert. No. 35, p. 330*).—The nitrogen assimilating capacity of a new species of Clostridium isolated by the author and named *Clostridium americanum* is compared with that of *C. pasteurianum* of Winogradski. It is shown among other things that the new Clostridium is much slower in its action than *C. pasteurianum.*

The bacteria of the root tubercles of leguminous plants, K. F. KELLERMANN and T. D. BECKWITH (*Centbl. Bakt. [etc.], 2. Abt., 16 (1906), No. 17–19, p. 540*).—The behavior of the micro-organisms of the root tubercles of velvet beans, soy beans, garden peas, and alfalfa on various culture media is briefly described.

The securing of a supply of nitrogen for agriculture in the twentieth century, A. STUTZER (*Deut. Landw. Presse, 33 (1906), No. 55, pp. 452, 453, figs. 4*).—This is a brief discussion of means of utilizing the nitrogen of the air by means of leguminous plants and electrical processes. The utilization at Notodden, Norway, of cheap water power for production of the electrical energy used in oxidation of the nitrogen of the air is especially referred to.

The apparatus devised for utilizing the nitrogen of the air, A. NEUBURGER (*Ztschr. Angew. Chem., 19 (1906), No. 22, pp. 977–985, figs. 17*).—The principles of construction and operation of the various forms of apparatus proposed for this purpose are briefly discussed.

The new Norwegian saltpeter industry (*Ugeskr. Landm., 1905, No. 52; Hedeselsk. Tidsskr., 1906, No. 2, pp. 20–24*).—The manufacture of nitrates by electrical processes at Notodden, Norway, is referred to.

The occurrence of sodium salts in Egypt with special reference to nitrate of soda, F. HUGHES (*Yearbook Khediv. Agr. Soc., Cairo, 1905, pp. 145–170, fig. 1*).—Lake and desert deposits are briefly referred to and the occurrence of sodium salts, especially nitrates, in the soils and drainage waters and in the natural manures known as koufri, marog, and tafla, is more fully discussed.

The salts most frequently found in soils are chlorid, sulphate, carbonate, and bicarbonate of sodium, the last two being much less abundant than the first two.

The occurrence of a large alluvial plain at Kom Ombo in Upper Egypt, which is impregnated with sodium chlorid, sulphate, and nitrate, is described, the nitrate occurring in sufficient amount to make the soil, which is known under the local name of marog, of value for fertilizing purposes. Analyses are reported which show as high as 5.9 per cent of nitrate in this soil. The salts are derived from clay hills immediately surrounding the plain.

Koufri, the most important natural manure of Lower Egypt, consists of the remains of old villages, which analysis shows to contain in some cases as high as 4.4 per cent of nitrate of soda besides various other salts.

The Esna shales (known as tafla) of Upper Egypt, containing from 6 to 8 per cent of nitrate of soda, are said to be the most important salt deposits in the country. A series of experiments in the extraction of this material, which gave a product containing 54 per cent of nitrate, is reported, and the economy of the process with limited water and fuel supply is discussed. The origin of the tafla salts is considered and the conclusion is reached that the nitrate which they contain has been produced by the decomposition of organic matter.

A bibliography of 25 references is given.

The manufacture of ammonium sulphate in Belgium (*Rev. Gén. Agron., n. ser., 1 (1906), No. 3, pp. 128, 129*).—This is a review of a report published by the minister of public works of Belgium, discussing especially the method of preparing ammonium sulphate by saturation of gas liquors with sulphuric acid. The annual production of Belgium is stated to be about 14,700 tons, 4,000 tons coming from gas works and 10,700 tons from furnaces.

Crude ammonia, L. BERGERON (*Jour. Agr. Prat., n. ser., 12 (1906), No. 32, pp. 177–179, fig. 1*).—The composition and use as fertilizer, weed destroyer, and insecticide of this by-product of gas making are briefly discussed. The composition of the material varies within the following wide limits: Water 10 to 25 per cent, ferrocyanid 5 to 15, free ammonia 0 to 2, ammonium sulphate 0.5 to 5, sulphocyanogen 0.5 to 7, ammonium cyanid 0.5 to 1, free sulphur 20 to 45. It is estimated that towns using gas produce about 1 ton of this material annually per 1,000 inhabitants. It is claimed that the material may be used with advantage as a fertilizer if applied from 1½ to 2 months before seeding. Applied at the rate of 30 gm. per square foot the material has been found to be a very effective weed destroyer. It has also been found to be quite useful in combating nematodes, phylloxera, and other parasites. (See also E. S. R., 17, pp. 951, 1142.)

Six years' field experiments with nitrogenous fertilizers at Parc des Princes, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 11 (1906), No. 23–24, pp. 702, 703*).—Field experiments on potatoes and corn fodder with different forms of nitrogenous fertilizers combined with various other fertilizing materials are briefly summarized, the results indicating that in general on a dry sandy soil poor in lime the action of nitric nitrogen is decidedly superior to that of ammoniacal or organic nitrogen.

Investigations on the changes which occur in the fermentation of manure, B. SJOLLEMA and J. C. DE RUIJTER DE WILDT (*Cultura, 18 (1906), Nos. 210, pp. 66–89, figs. 2; 211, pp. 130–141, fig. 1*).—The apparatus and methods used and the results obtained in studies of aerobic and anaerobic fermentation of manure at different temperatures are discussed and pot tests of fresh manure and that fermented under different conditions, in comparison with other fertilizers, are reported.

The investigations show that under certain conditions there may be a large loss of free nitrogen from fermenting manure, the extent of the loss depending largely upon the air supply. If the supply of air is cut off the loss of nitrogen in this form ceases. If air is freely admitted and the temperature maintained at about 50° C. ammonia is rapidly formed, but no free nitrogen is evolved. Excluding air, however, does not entirely prevent the formation of ammonia. Temperature appears to be a very important factor in determining the character of changes which occur. By fermentation at a low temperature with a deficient air supply, nitrogen compounds are formed which are not readily available to plants. The readily available albuminoid nitrogen of manure is assimilated by plants during the first year, and in case of some kinds of manure more than one-third of the nitrogen is taken up by plant roots within a few months. The ammonia content is not an exact measure of the effectiveness of the nitrogen in stable manure.

Experiments with lime as a preservative of manure, M. WEIBULL (*K. Landtbr. Akad. Handl. och Tidskr., 45 (1906), No. 1, pp. 3–15; abs. in Chem. Ztg., 30 (1906), No. 62, Repert. No. 25, p. 254*).—Experiments were made by the author during the years 1903–4 to study the preserving effect of lime on barnyard manure, and during the seasons 1903–1905 to study the fertilizer value of common and limed manure for wheat, potatoes, mustard, and fodder beets.

The average losses of the manure in weight, organic matter, total nitrogen, and ammonia during 3 to 3½ months were as follows: For common manure, loss in weight 25.9 per cent, organic matter 26.3, total nitrogen 16.5, and ammonia 40.7. For the limed manure (the lime being applied at the rate of 1.2 kg. per head daily): Loss in weight 22.3 per cent, organic matter 22.2, total nitrogen 16.9, and ammonia 41.6. The results of the field trials showed that, in the case of all the crops experimented with, the limed and the common manure possessed a similar fertilizer effect, thus indicating that these crops are able to appropriate similar amounts of nitrogen from both kinds of manure when this is well cared for and handled in a similar way.—F. W. WOLL.

Does didymium chlorid, a new disinfectant and preservative material, injuriously affect plant growth? O. BÖTTCHER (*Deut. Landw. Presse, 32* (*1905*), *No. 90, pp. 752, 753; abs. in Centbl. Agr. Chem., 35* (*1906*), *No. 7, pp. 451, 452*).—Experiments are reported which indicate that this material, which is now being put on the market in Germany at prices which permit of its use as a disinfectant and preservative, is an effective preservative of manure and, in amounts necessary for this purpose, has no injurious effect upon plants.

The relation between the care of liquid manure and its content of valuable fertilizing constituents, A. STUTZER and P. VAGELER (*Fühling's Landw. Ztg., 55* (*1906*), *No. 10, pp. 338–348*).—Analyses of a large number of samples of liquid manure produced under a variety of conditions of care and management are reported, showing wide variations in composition with different methods of preparation and handling.

Phosphates in New Zealand, B. C. ASTON (*New Zeal. Dept. Agr., Chem. Div. Bul. 1, pp. 10, pls. 4, figs. 4*).—The deposits of phosphate which have already been discovered and exploited in New Zealand are briefly described and the terms of a bonus offered to encourage further discovery of phosphates in the island are explained. One of the most important recent discoveries of phosphates is that occurring in limestone pockets near Clarendon, Otago.

"New Zealand mineral phosphate, which has hitherto been found in workable quantities only at Milburn and Clarendon, Otago, has a dirty yellowish-white or light-gray color. Some specimens exhibit a decided pink tinge in patches. It is usually amorphous (non-crystalline), but thin veins of crystalline apatite have been found at Clarendon. . . . Since the discovery of phosphate at Clarendon some 15,000 tons of the fertilizer have been quarried, ground, and put on the market."

Phosphates in Nantes, L. GOLDSCHMIDT (*Daily Consular and Trade Rpts.* [*U. S.*], *1906, No. 2636, pp. 5, 6*).—In connection with statistics of importation of phosphates into Nantes attention is called to the fact that formerly phosphates of high grade were imported into this city from Mona Island on the east coast of Porto Rico, and while the exploitation of these deposits ceased after a relatively short period it is believed that they may be worked with advantage.

The action of difficultly soluble phosphates on rye by means of lupines, A. MAYER (*Deut. Landw. Presse, 33* (*1906*), *No. 52, pp. 433, 434*).—Field experiments are reported which show that insoluble phosphates applied to a previous crop of lupines gave better results at less cost in case of the following crop of rye than superphosphate.

The selection and use of fertilizers, W. P. BROOKS (*Farming, 2* (*1906*), *No. 2, pp. 50, 51*).—This article is based on the "better farming" talks delivered on the special trains recently run through New England, and outlines briefly the principles which should guide in the purchase and use of fertilizers. It advocates the purchase of high-grade fertilizers especially adapted to the soil

and crop conditions in each case. The growth of beets on limed and unlimed plats is recommended as a good practical means of determining whether the soil is acid. The more generally useful results of fertilizer experiments on various crops at the Massachusetts Station are briefly summarized.

Food for plants (*New York: William S. Myers, 1905, rev. ed., pp. 241, figs. 42*).—This is a new edition, with supplementary notes, of this compilation prepared mainly from the writings of Joseph Harris and from the work of the various agricultural experiment stations. Notes and tables giving miscellaneous information are included.

Commercial fertilizers, G. ROBERTS (*California Sta. Bul. 179, pp. 57–83*).—This bulletin gives the results of fertilizer inspection for the second half of the fiscal year 1905–6, the results of the first half year having been published in Bulletin 173 of the station (E. S. R., 17, p. 1051). It reports examination of 239 samples of fertilizing materials, of which "22 were sent by farmers under the two-dollar fee provision, 56 were taken by inspectors from purchasers' goods upon the request of the purchasers, and 161 were taken by inspectors from goods in the hands of agents and manufacturers." The valuation of fertilizers is briefly discussed and suggestions are made regarding the purchase of fertilizers.

Analysis of commercial fertilizers sold in Maryland, H. B. MCDONNELL ET AL. (*Md. Agr. Col. Quart., 1906, No. 33, pp. 56*).—Tables are given which show the guaranteed and actual composition and comparative value per ton of fertilizers inspected by the State chemist from February to July, 1906, inclusive.

Analyses of commercial fertilizers, W. FREAR (*Penn. Dept. Agr. Bul. 142, pp. 61*).—This bulletin gives the results of fertilizer inspection in Pennsylvania during the 5 months ended December 31, 1905.

A review of progress in the fertilizer industry for the year 1905 (*Ztschr. Angew. Chem., 19 (1906), No. 32, pp. 1390–1392*).—This is a brief review of progress made, especially in Germany, during the year in enlargement of plants and in development and improvement of milling and mixing machinery, methods and processes, and products. Considerable progress was made during the year in the enlargement of factories with their own sulphuric-acid plants, but the business was handicapped by a scarcity of labor and the profits were not large.

The fertilizer season records, W. L. SUMMERS (*Jour. Dept. Agr. So. Aust., 10 (1906), No. 1, p. 18*).—Statistics are given of the fertilizer trade in South Australia for the period 1897–1906. It is shown that the use of fertilizers has increased from 3,000 tons on 60,000 acres in 1897 to 59,000 tons on 1,321,600 acres in 1906. Of the fertilizers now used it is estimated that 95 per cent consist of superphosphates in some form or other.

Consumption of fertilizers, season of 1905–6 (*Amer. Fert., 25 (1906), No. 2, pp. 12, 13*).—Statistics are given for Mississippi, North Carolina, West Virginia, Kentucky, Florida, Missouri, Alabama, Tennessee, Texas, and California.

Sludge treatment in relation to sewage disposal, J. D. WATSON (*Engin. Rec., 54 (1906), No. 9, pp. 225, 246–249*).—The author reports experiments at Birmingham, England, in which exceedingly satisfactory results were obtained with the septic tank treatment for separating suspended matter from sewage, the sludge being disposed of on land. It is claimed that with the plant used the sewage of 900,000 people is disposed of without any objectionable odors at a cost of about 5 cts. per cubic yard of wet sludge.

The sewage is allowed to flow through a series of septic tanks at an average lineal velocity of about 1.2 ft. per minute; "the street wash and other coarse detritus are deposited in the first compartment of the septic tanks and removed about once a week; a large portion of what might be termed 'grit chamber

deposit' is pumped forward into the septic tanks; the deposit in the septic tanks is reduced to an inodorous humus mass by bacterial activity; and at intervals of about seven weeks or so the inodorous septic sludge is pumped upon adjoining lands, covering the same to a depth of some 8 to 10 in. . . . By absorption and evaporation the loss of water causes this sludge to be reduced to somewhat less than half its original bulk, and there results a fairly dry mass which thus far has been of little service for purpose of cultivation."

Rye gave unsatisfactory results on soil treated with sludge in the manner described. Italian rye grass gave better results. In black soil mixed with an equal amount of the sludge about one-third of various garden seeds germinated, but did not mature. "It was therefore quite clear that it was a mistake to run so much sludge on the surface of the land at one time, and in subsequent working not more than half the amount of sludge has been put on the surface of the ground, with far more satisfactory results."

AGRICULTURAL BOTANY.

Flora of the State of Washington, C. V. Piper (*U. S. Nat. Mus., Contrib. Nat. Herbarium, 11, pp. 637, pls. 22, map 1*).—An account is given of the flora of the State of Washington, based upon the author's study of the plants of that State during a period of 20 years.

The principal aim in the work is to present a summary of our present knowledge of the vascular plants of Washington and to call attention to some of the more important taxonomic and ecological problems which are disclosed. The author describes the early botanical explorations of Washington, and gives an account of the physiography, geology, and climate of the State, after which he discusses the distribution of plants and gives an account of regions of peculiar botanical interest. Following this an annotated catalogue of the species of vascular plants of Washington is given, and an extended bibliography and index completes the publication.

Absorption of atmospheric moisture by desert shrubs, V. M. Spalding (*Bul. Torrey Bot. Club, 33 (1906), No. 7, pp. 367–375*).—The author has been led to investigate the subject of the absorption of water directly from the atmosphere by leaves and other aerial parts of plants, and in the present paper gives a summary of his investigations.

It is found that of 12 species of desert perennials subjected to experiment all exhibited some slight capacity for direct absorption of water from the atmosphere, but in general the amount absorbed is very insignificant in comparison with that given off in corresponding periods in dry air. So far as the observations go, there appears to be no evidence that the quantities of water so absorbed are utilized in the body of the plant. The rapidity with which the water thus absorbed is returned to the atmosphere suggests that the process is a physical one and of no physiological significance.

This investigation seems to show that the roots of desert plants constitute their only reliable active agent in providing a normal water supply.

The relation of desert plants to soil moisture and to evaporation, B. E. Livingston (*Carnegie Inst. Washington Pub. 50, pp. 78, figs. 16*).—Studies were carried on at the desert laboratory of the Carnegie Institution, which is located near Tucson, Ariz., with reference to the relation between certain desert plants and their physical environment. The studies recorded are the results of an attempt to determine some facts in regard to the minimum water supply with which desert plants can thrive.

After discussing the relation of the soil and atmosphere the author takes

up the study of the plant. The main physical factor which was found to determine the nature of the vegetation on Tumamoc Hill near the laboratory was the water relation. Except during the rainy seasons, the soil on this hill is far too dry for most plants, and only those forms can live there that are adapted to dry soils and a high rate of evaporation.

Studies of the minimum water supply for germination of seeds were also made. With desert plants such as *Fouquieria splendens* and the giant cactus germination took place in soils containing from 15 to 20 per cent of moisture. For purposes of comparison a number of seeds of cultivated plants were investigated in the same way, and it was found that Mexican beans and wheat germinated in 15 per cent, but more vigorously in 20 per cent moisture in the soil; the cultivated balsam germinated slightly in 20 per cent, but much better in 25 per cent; radishes failed to germinate in soil containing less than 20 per cent moisture, and red clover did not germinate until a moisture content of at least 25 per cent had been reached.

In summarizing his conclusions, the author states that the deeper soil layers of Tumamoc Hill contain at the end of the dry season a water content adequate to the needs of those desert plants which are active during the months of drought. The soil moisture is conserved very largely by the high rate of evaporation and the consequent formation of a dust mulch.

Desert plants show an adaptation to existence in dry soil, being able to exist in soils somewhat drier than those needed by plants of humid regions, but this adaptation is comparatively slight and is not considered of primary importance. The downward penetration of precipitation water is slow in the soil itself, but comparatively rapid on the whole on account of the presence of numerous oblique rock surfaces along which the flow is not markedly impeded. By the middle of the summer rainy season all of the soil except the first few centimeters is sufficiently moist to allow the germination and growth of most plants. The seeds of *Fouquieria splendens* and *Cereus giganteus* failed to show any special adaptation to germination in soils drier than those needed by such seeds as beans and wheat.

Immediately following germination the seedlings of desert plants exhibit a slow aerial growth, but an exceedingly rapid elongation of the primary roots, so that these should soon attain to depths where moisture is always present in an amount adequate for growth. The high moisture-retaining power of the soil where these investigations were carried on holds near the surface much of the water received from single showers and offers excellent opportunity for the rapid absorption of this by shallow-growing plants, such as the cacti.

In the conduct of these experiments the author found that the effect of air currents in increasing evaporation and transpiration is so great that measurements of natural transpiration can not be made in closed chambers, and by means of a specially devised apparatus a physiological regulation of the rate of transpiration was shown to exist in the forms studied. The regulation of transpiration seems to be controlled by air temperature, the checking of water loss beginning to be effective between 79° and 90° F., and disappearing between 75° and 80° F.

A study of the variations in the nitrogen and phosphoric acid in the juices of succulent plants, G. André (*Compt. Rend. Acad. Sci.* [*Paris*], *142* (*1906*), *No. 15, pp. 902–904*).—A study of the variation in these constituents in *Mesembrianthemum cristallinum* at different stages of growth showed that the soluble phosphoric acid and nitrogen reached their maxima at the same periods of growth. The content of nitric acid in the juice was always comparatively large.

Cyanogenesis in plants, IV-V, W. R. DUNSTAN, T. A. HENRY, and S. J. M. AULD (*Proc. Roy. Soc.* [*London*], *Ser. B, 78* (*1906*), *No. B523, pp. 145–158*).—The authors are making a systematic investigation of various plants with a view to ascertaining definitely whether they contain phaseolunatin. They have already reported upon the presence of this glucoside in *Phaseolus lunatus* (E. S. R., 15, p. 556), and in the present papers they deal with investigations with flax and cassava plants.

Previous investigators have reported the presence of a glucoside, linamarin, in flax, and the authors' studies have been carried on to determine its possible identity with phaseolunatin. In the isolation of the glucoside it is found that the flax plant differs from *Lotus arabicus* and *Sorghum vulgare*, which show a steadily increasing amount of glucoside until the plant approaches maturity, after which it decreases until there is none present in the seed. In the flax the seed contains a small amount of glucoside, which increases on germination, and reaches a maximum when the plants have attained a height of 2 or 3 in., after which it gradually diminishes and finally disappears. The authors isolated the glucoside from flax plants about 4 or 5 in. in height in which stems, leaves, and roots were used. The material obtained was compared with phaseolunatin, and the two substances proved to be identical. A study of the enzym of the flax showed that it would hydrolyze phaseolunatin from the seeds of *Phaseolus lunatus* and vice versa, so it seems probable that the enzym in both plants is identical.

In the second paper a report is given on the occurrence of phaseolunatin in cassava plants, the studies being made largely of the rind of the bitter root, which was specially prepared for the investigation. From this material a glucoside was separated which does not differ in any way from that obtained from the other plants mentioned above, and the enzym is closely related to, if not identical with, the emulsin-like ferment obtained from the seeds of *P. lunatus* and from young flax plants. It appears from the investigations that these plants, representing three widely separated orders, contain the same glucoside.

Additional species of rosaceous plants containing hydrocyanic acid, L. GUIGNARD (*Compt. Rend. Acad. Sci.* [*Paris*], *143* (*1906*), *No. 14, pp. 451–458*).—Hitherto most of the species of rosaceous plants that have been reported to contain hydrocyanic acid in their foliage have belonged to the tribe *Pruneæ*. The author made extended investigations and found that a considerable number of species belonging to other tribes also contain hydrocyanic acid in their leaves. The amounts present vary from a mere trace to as great a content as that reported for the cherry laurel. The number of species known to contain hydrocyanic acid is about double that previously reported.

The latent vitality of seeds, P. BECQUEREL (*Compt. Rend. Acad. Sci.* [*Paris*], *142* (*1906*), *No. 26, pp. 1549–1551*).—The author reports investigations on 550 species of seed, representing 30 of the more important families of plants, the seeds having been kept in storage from 25 to 135 years.

In the experiments at least 10 seeds were selected, carefully washed in sterilized water, and partially decorticated so as to make the integuments permeable. They were then placed on aseptic cotton under glass covers and kept at a uniform temperature of 28°. The results of the investigations are given in detail. Eighteen out of 90 leguminous species germinated, as well as 3 species of Nelumbium seed, 1 species of Malvaceæ, and 1 of Labiatæ. These seeds ranged in age from the season of 1819 to 1878, and in the case of one species of Nelumbium to 1888. No seed germinated belonging to any of the Gramineæ, Liliaceæ, Urticeæ, Polygonaceæ, Chenopodiaceæ, Ranunculaceæ, Eu-

phorbiaceæ, Cruciferæ, Papaveraceæ, Rosaceæ, Solanaceæ, Boraginaceæ, Convolvulaceæ, Verbenaceæ, Plantagineæ, or Cucurbitaceæ.

Among species of seed ranging from 30 to 60 years old, the author failed to get any germination of a number that have been frequently reported by other observers as having germinated after long periods of time. The oldest seed, which had retained its vitality for 80 years, included 3 species of leguminous seed protected by very thick integuments. In such seeds the seed coats seemed, through their impermeability, to have brought about a thorough drying of the seed such as is artificially produced by drying over chemicals or in vacuum, and in this way the reserve material was protected from oxidation.

FIELD CROPS.

Crop rotation, J. S. Cole (*South Dakota Sta. Bul. 98, pp. 75–103*).—The experiment here reported has been in progress since 1897. Earlier results have been previously noted (E. S. R., 15, p. 237), and a revised outline is here given. The purpose of the present bulletin is to show which crops reduce soil fertility and which maintain its productivity. The best order of succession of crops is also shown as indicated by these results.

The best average yields of wheat were secured after either corn or potatoes. Results following these two in order of merit were obtained from summer fallow, millet, vetch, peas, wheat, and oats. The introduction of a cultivated crop into the rotation was found to become more important as the conditions for the production of a maximum total crop were more unfavorable, especially if due to a dry season. It was found that wheat is a more particular crop than oats and requires a better place in the rotation.

The culture of Canada field peas and vetch increased the growth of straw in the following crops, but gave no material increase in the yield of grain. This was most marked where the peas were plowed under as green manure or fed off with hogs. Green manuring with peas has so far shown no benefits over a summer fallow.

At the end of 8 years land growing wheat and corn alternately is producing better total crops of wheat than land growing wheat alternately with vetch and with summer fallow. Manuring land growing wheat alone has so far not been profitable, but a decided profit was secured in manuring land for corn. Where the corn crop was manured a residual effect was observed for at least 4 years.

It is believed that in the best rotations for South Dakota the land should be sown to some perennial grass for a short term of years and that brome grass is well adapted to this use.

Flax was not more exhaustive of the fertility of the soil than the other grain crops.

Results of culture experiments in 1905 (*Ghodīchnuiĭ Otchet Ploty. Selsk. Khoz. Opuitn. Stantziĭ, 11 (1905), pp. 25–72, 125–127*).—In a dry season the influence of the bare fallow and of the depth of working the soil was very feeble, but the use of barnyard manure in growing leguminous forage plants gave good results. Of different commercial fertilizers used the phosphates were most effective, giving an apparent increase of 16.5 per cent in the cereal crops and of 25 per cent in the crop of sugar beets. The leading varieties of winter wheat were Banat and Champagne, both early sorts, yielding 1,770 kg. of grain per hectare, followed by Don, a medium early variety, with about the same yield.

Owing to the dry season the spring wheat varieties gave but small yields,

with indications that Oulka among the soft wheats and Garnovka and Epi noir among the hard wheats, are best adapted to the region.

Some varieties of barley, including Stockmannsoder, Minnesota, and English D, matured in 101 days, while several others, including Montana Chevalier, required 114 days. The heaviest grain-yielding varieties were Escourgeon du Midi, Bavarian, Hungary, and Chevalier, and the lightest grain-yielding varieties were Svalöf, Pedigree, Wisconsin, and Pomelle. The results further showed that Escourgeon du Midi ranked first in stooling capacity and produced the largest number of grains per head, and that Auvergne occupied first place in the weight per thousand grains.

The blossoming of barley, C. Fruwirth (*Fühling's Landw. Ztg., 55 (1906), No. 16, pp. 544–553*).—The author reports the results of his own observations on the process of blossoming in the different kinds of barley and reviews the observations made by other investigators in this same line of work.

The respiration of barley, O. Qvam (*Tidsskr. Norske Landbr., 13 (1906), No. 6, pp. 263–284*).—Investigations were conducted to establish the relation between the germination of seeds and the amount of carbon dioxid given off in the process of germination, and to devise ultimately a method by which the more rapid determination of the respiration of seeds might be substituted for germination tests. Similar work by other investigators is described, together with a report on the methods and the apparatus used by the author. In the tests made it was observed that the quantity of carbon dioxid respired by the seeds increased with the increase in temperature and the moisture content of the grain.—F. W. WOLL.

The study of corn, V. M. Shoesmith (*Kansas Sta. Bul. 139, pp. 223–249, figs. 12*).—This bulletin is a guide in elementary corn judging. Notes on the history, types, and varieties of corn, rules for judging, discussion of points of the score-card, and a description of corn breeding and improvement are given.

Cotton culture in Korea (*Diplo. and Cons. Rpts. [London], 1906, No. 654, pp. 11*).—A report is given on the result of experiments in cotton culture in Korea. It is shown that upland cotton is apparently well adapted to that country, the crop being considerably heavier than that of the native plant.

In a comparison of the 2 types of cotton the only difference in season observed was in the bursting of the pod, which was later in the upland cotton on account of the larger boll produced. Upland cotton gave a larger yield than the native variety even when the buds and superfluous shoots were not pinched out. The upland type not only gave a greater percentage of ginned cotton than the native plant, but the fiber was also longer and finer. It is estimated that about 298,200 acres of cotton are grown in Corea, and that this area represents about 4.5 per cent of the total cultivated land of the country.

Improvement of cotton by seed selection, T. Thornton (*West Indian Bul., 7 (1906), No. 2, pp. 153–170*).—A general discussion of the subject is given and the work with seed selection in Barbados during 1905–6 is described. It is stated that out of 264 plants first selected in the field only 14 gave satisfaction in all the characteristics examined. In determining the qualities of the samples the length of staple, the proportion of lint to seed, the proportion of weak fibers, diameter of fibers, silkiness, and fineness was considered, and the data thus secured are given in a table.

A test of commercial cultures for legumes, G. C. Butz (*Pennsylvania Sta. Bul. 78, pp. 13*).—Seed of alfalfa, vetch, soy beans, and cowpeas inoculated with a commercial culture was compared with the same kinds of seed not so treated in flowerpots filled with sterilized sand to which was added a

sufficient quantity of mineral plant food. The object of the experiment was mainly to test the activity of the bacteria by the production of root nodules. The germination in all cases seemed to show no effect due to the treatment. As to growth, alfalfa and soy beans showed no decided advantage from the use of the commercial culture. In the case of vetch the bacterial culture had apparently been effective in one pot. With cowpeas slight differences in favor of inoculation were also perceptible.

The same experiment was carried out in the field and the results in general confirm those obtained with pot culture. The soy beans which produced no nodules in the pot-culture tests showed a decidedly heavy production in the field, and this was apparently in favor of the inoculation.

Culture tests with potatoes in 1905, H. J. DANNFELT and S. RHODIN (*K. Landtbr. Akad. Handl. och Tidskr., 45 (1906), No. 2, pp. 92–131*).—A report on experiments conducted by the Royal Swedish Agricultural Academy in 9 different counties of Sweden.

In the fertilizer tests at the experiment station of the Royal Swedish Agricultural Academy the relative value of nitrate of soda, Norwegian lime niter, ammonium sulphate, and calcium cyanamid was studied. In each case 53.4 lbs. of nitrogen was applied per acre, with 134 lbs. of potash in 37 per cent potash salt, and 50 lbs. of citric-acid soluble phosphoric acid in the form of Thomas phosphate. The highest average yield, 27,871 lbs. per acre with a starch content of 12.5 per cent, was secured with lime niter, and the lowest, 21,108 lbs. with 13.4 per cent of starch content, with no nitrogen. Calcium cyanamid ranked first in starch production with 3,495 lbs. per acre, the starch content of the tubers being 12.7 per cent, and was followed by ammonium sulphate, lime niter, and nitrate of soda in the order given, with no nitrogen standing last with a yield of 2,828 lbs. Calcium cyanamid was most profitable and nitrate of soda least so.

Planting from May 5 to 22 gave better results than planting earlier or later. Minimum and optimum temperatures for germination of potatoes were determined as 4 to 5° C. and 10 to 12° C., respectively. Whole medium-size potatoes produced the highest yields, outranking different kinds of cut sets and small whole tubers. Planting 50 by 25 cm. apart gave the best results, but for convenience in cultivation it is recommended that the rows be placed 60 cm. apart with plants from 15 to 20 cm. in the row. Planting 10 cm. deep gave better results than planting 15 cm. or 5 cm. deep.

In the variety tests the largest yields of tubers were obtained from Evergood, Chieftain, and Nero Guardian, and the highest yields of starch from Brocken, Diana, Modrow Industrie, and Sas. In starch content Brocken and Vega ranked first with 19.5 per cent, being followed by Deutscher Reichskanzler with 18.5 per cent, and Saxonia with 17.1 per cent. All the varieties mentioned were quite resistant to disease except Diana and Saxonia.

Observations for a series of years on Swedish farms have shown that the yields of Magnum Bonum during late years have been somewhat higher than before, while the starch content and the palatability of the tubers have decreased. The disease resistance of the variety is essentially unchanged.

The seed of 3 strains of Magnum Bonum potatoes, imported from Scotland, showed a higher productive capacity and a greater resistance to disease than acclimated home-grown seed, but in starch content the tubers from the Scotch seed stood lower than those from the home-grown seed.—F. W. WOLL.

Potato culture experiments, 1905, M. WEIBULL ET AL. (*Malmö. Läns K. Hushåll. Sällsk. Kvrtlsskr., 1906, No. 1, pp. 120–169*).—Cooperative experiments were conducted at 25 different farms in southern Sweden. Of the varieties

under test Agnelli headed the list with a yield of 26,700 lbs. of tubers and 4,486 lbs. of starch per acre, the average starch content being 16.8 per cent. Fürst Bismarck, the variety ranking first in starch content with 19.5 per cent, yielded 18,307 lbs. of tubers and 3,569 lbs. of starch per acre.

In fertilizer experiments, in which an application of 223 lbs. of nitrate of soda and 178 lbs. each of 20 per cent superphosphate and 37 per cent potash salt was used, the yield of potatoes was apparently increased from 20,897 lbs.—the yield of the unfertilized plats—to 24,956 lbs. per acre. The quantity of starch produced per acre on the unfertilized plats was 4,103 lbs. and on the fertilized plats 4,521 lbs. The use of the fertilizer, on the other hand, seemed to have decreased the starch content from 19.7 to 18.2 per cent.

In another series of experiments with the same varieties of potatoes the effect of the application used in the previously described tests was compared with the results secured from the use of 134 lbs. each of nitrate of soda, 20 per cent superphosphate, and 37 per cent potash salt, given with 17,800 lbs. of barnyard manure per acre. The check plats yielded 17,827 lbs. of tubers per acre, the plats receiving commercial fertilizers alone 21,529 lbs., and the plats treated with commercial fertilizers and barnyard manure 24,048 lbs. The yield of starch for the 3 series of plats was 3,284 lbs., 3,622 lbs., and 4,121 lbs. per acre, and the average starch content 18.3, 16.8, and 17.1 per cent, respectively.—F. W. WOLL.

The influence of the vegetative period and of the fertilizer used on the chemical composition of potato tubers, P. VAGELER (*Fühling's Landw. Ztg., 55 (1906), No. 16, pp. 556–563*).—It is pointed out from the results of experiments that the specific gravity and the content of dry matter increase with the length of the vegetative period. Mineral matter and nitrogen were not taken up by the tubers after the end of July. As the vegetative period progressed the quantity of stored starch increased, the increase being greatest in August, but somewhat reduced in September.

A general application of lime, barnyard manure, or the two fertilizers given together, increased the water content, ash, chlorin, potash, total nitrogen, nitrogen-free extract, sugar, and dextrin of the tubers. The use of barnyard manure increased the quantity of crude fiber, while liming reduced it. Without a general application the use of potash increased the water, ash, chlorin, potash, and protein content, and in a lesser degree the nitrogen-free extract and sugar content, while phosphoric acid increased in a lesser degree the moisture and ash content, the quantity of nitrogen compounds, with the exception of the amid and total soluble nitrogen content, and nitrogen-free extract. The nitrogenous fertilizers largely reduced the specific gravity, ash, phosphoric acid, starch, and crude fiber, while the quantity of all other components was increased by this treatment.

In connection with liming, applications of potash gave an increase in the moisture content, ash, nitrogen-free extract, insoluble albuminoids, and starch. The use of phosphoric acid remained neutral with reference to water, total ash, chlorin, potash, proteids, and sugar, but its use increased the specific gravity and the phosphoric acid, total and insoluble nitrogen, and crude-fiber content, while the quantity of soluble ash, soluble amid, and albuminoid substances and starch were greatly reduced. An application of nitrogen favored an increase in specific gravity, water, phosphoric acid, and all nitrogenous substances with the exception of albuminoids. The quantity of total ash, soluble ash, chlorin, potash, starch, and to a very small degree crude fiber, were reduced through nitrogen fertilization.

With barnyard manure as a general application potash increased the water

content, the quantity of all ash components with the exception of phosphoric acid, the insoluble nitrogen, albumin and albuminoid nitrogen, nitrogen-free extract, and the starch. All other constituents, as well as the specific gravity, were reduced. Phosphoric acid increased the quantity of water, the ash constituents with the exception of the soluble ash, which was greatly depressed, the nitrogen compounds, nitrogen-free extract, starch, and crude fiber. An application of nitrogen increased the quantity of water, the total and soluble ash, chlorin, and especially the nitrogen content, while it had no effect on the starch content and reduced the specific gravity.

Where lime and barnyard manure were used as a general dressing, potash applied as a fertilizer favored an increase in specific gravity, total ash, soluble ash, chlorin, potash, phosphoric acid, albuminoid nitrogen, and starch; showed no effect on the moisture and nitrogen-free extract content, and decreased the quantity of all other constituents. Phosphoric acid had a favorable influence on the water, total ash, chlorin, potash, phosphoric acid, total and albuminoid nitrogen, nitrogen-free extract, starch, and crude fiber. This result was analogous to its action where barnyard manure alone was given as a general application. The use of a nitrogenous fertilizer increased the moisture content, the ash constituents, total and soluble nitrogen, albuminoid nitrogen, nitrogen-free extract, and crude fiber, and reduced the quantity of the other substances.

Trial tests with rye, F. HANSEN ET AL. (*Landmandsblade, 39 (1906), No. 24, pp. 298–300*).—Results secured at the state experiment stations for plant culture in Denmark showed that during the period 1895–1904 Bretagne and Petkus rye were the most valuable varieties under test.—F. W. WOLL.

Comparative tests with varieties of sugar cane, C. F. ECKART (*Hawaiian Sugar Planters' Sta., Dir. Agr. and Chem. Bul. 17, pp. 20*).—The results of a plant crop of 17 varieties of sugar cane were reported in Bulletin No. 12 of this station (E. S. R., 17, p. 761), and the data given in this bulletin refer to the ratoon crop of this same planting. These results, including sugar yields and the quality of the juices, are compared with the plant cane results previously reported. In addition, the results secured with introduced seedling canes together with a few native and other varieties are also given. The tables presented also include information regarding the check of growth in the cane due to the winter season and the relative rapidity of recovering normal development under favorable conditions. All results are tabulated without comment.

Macaroni or durum wheats, J. H. SHEPARD (*South Dakota Sta. Bul. 99, pp. 105–115*).—This bulletin is a continuation of Bulletin 92 of the station (E. S. R., 17, p. 269). As heretofore, comparisons with Russian, Mediterranean, and miscellaneous macaroni wheats were made, and the data secured are tabulated with brief comments.

Kubanka 5639 for 1904 and 1905 yielded the largest per cent of protein. It was observed that the total protein was less in all varieties in a wet season than in a dry one, but it is considered evident that the durum wheats will not suffer protein diminution in that climate.

The bread and macaroni tests showed that the loaf volume did not vary greatly among the better varieties. Arnautka and Wild Goose, two heavy yielding varieties, were compared with the other sorts, but they showed no particular superiority in any of these tests.

It is pointed out that the durum wheats carry more protein than the bread wheats, but that the gliadin content is usually lower, and that apparently the greater per cent of gluten offsets in a measure the lack of gliadin in bread making.

The results secured during the years 1904 and 1905 are regarded as reaffirm-

ing those reported in 1903. On the strength of these experiments Kubanka 5639 is recommended for more general use.

HORTICULTURE.

Studies in plant breeding in the Tropics, R. H. Lock (*Ann. Roy. Bot. Gard. Peradeniya, 2 (1904), No. 2, pp. 299–356; (1905), No. 3, pp. 357–414*).—The author gives brief historical notes on the general subject of plant breeding, giving special attention to the results secured by Mendel and the confirmation of these by more recent experimenters.

Details are also given of a large amount of the experimental work by the author in crossing various cultivated peas with native peas. The results obtained in these experiments are in the main confirmatory of those secured by Mendel, although several exceptions occurred. A bibliography of 80 papers on various phases of plant breeding is included.

Truth about ginseng culture, W. M. Evans (*Rural New Yorker, 65 (1906), No. 2957, p. 727*).—The author discusses the condition of 3 ginseng plantations of considerable size which he recently visited. The ginseng had been planted for 3 or 4 years and involved an initial outlay of considerable money. Blight has seriously injured the growth and productiveness of the plantations in every instance. Two of the plantations have been practically abandoned and the third has not begun to pay expenses.

Seed packing for the Tropics, W. H. Patterson (*Gard. Chron., 3. ser., 40 (1906), No. 1033, p. 255*).—Germination tests were made of seed sent from England to the West Indies in ordinary paper packets. The tests were made (1) on receipt of the seed, (2) at the end of the month, (3) at the end of 2 months. The seeds germinated well at the end of the first and second months and fairly well at the end of the third month in the case of beans and peas. It is not deemed advisable to attempt to grow seeds that have been kept for a longer period than this in the Tropics.

Data are also given for a similar test with a large number of vegetable seeds sent out from Kew. As a result, the writer thinks it is not so much a question of the temperature and moisture as of ravages of small ants and weevils after the arrival of the seed in the Tropics.

Fruit industry (*Daily Consular and Trade Rpts. [U. S.], 1906, No. 2676, pp. 1–6*).—Statistics are given showing the total exports of fruits from the United States to different European countries in 1905. The largest amount of green and canned fruit is shipped to Great Britain, while Germany is our greatest purchaser of dried fruits, many of which are used for the manufacture of jelly, marmalade, etc. The total exports of fruit for the year ended June 30, 1906, were valued at $14,964,158. In 1904 the value was $20,347,699, and in 1905 $15,297,391.

Statistics and fruit-crop report, A. W. Peart (*Proc. Conference Fruit Growers Canada, 2 (1906), pp. 19–26*).—Tables of statistics are given showing the number of bearing and non-bearing fruit trees in Canada and each of the provinces in 1901, the yields of the same in bushels and an estimate of the value. Data on the yields, value, and acreage of grapes and small fruits are also given, and tables showing the apples exported from Canada during each of the 10 years previous to June 30, 1904, and the countries to which they were shipped.

Varieties of fruit for the home orchard, H. L. Price (*Virginia Sta. Bul. 161, pp. 123–144, figs. 13*).—Brief descriptions are given of a few of the better varieties of each of the different orchard and small fruits which may be

grown in the home garden. Directions are also given for laying out and planting orchards.

The drying up of orange trees as the result of autumn siroccos, F. Bouf and P. Genet (*Bul. Soc. Hort. Tunisie, 5 (1906), Nos. 18, pp. 20–27, dgms. 4; 19, pp. 52–58, dgms. 9*).—The authors made a study of why the drying wind of the fall sirocco is so much more injurious to citrus fruits than earlier in the season. Anatomical studies were made of the leaves of a number of citrus fruits such as the orange, citron, mandarin, pomelo, sour orange, etc.

Generally it was found that the resistance to the drying wind was greater in young leaves than in old leaves. Hence, in the spring and summer, when the circulation of sap is most rapid, these winds are less injurious than later when the leaves become older and sap circulation is much slower. In order to avoid the injurious effects of the drying winds so far as possible it is suggested that the trees be pruned in summer time. This will cause new shoots to push out, bearing fresh young leaves, which will be more resistant at the time of the autumn sirocco. This pruning must be done with considerable discretion, of course, as the removal of any large parts of the leaves would seriously injure the maturing of the fruit.

It was also found that when the cultivated oranges are grafted on sour orange stock the sap circulation was not as free as when other stocks were used. Hence stocks other than sour orange are urged.

Oil palm culture, L. Strunk (*Tropenpflanzer, 10 (1906), No. 10, pp. 637–642*).—Physical analyses are given of the fruit of a number of varieties of oil palm grown in Kamerun and also of the fruit produced on seedling trees from productive mothers. With the better varieties of oil palms the proportion of kernel to shell was usually greater than 1:2, while in the varieties usually grown the relation of kernel to shell varied from 1:3 to 1:4. Seedlings grown from productive oil-bearing mothers did not uniformly inherit the tendency to oil productiveness. Seed from the seedlings, however, which were rich in oil is to be planted to see if a strain rich in oil can not be secured which will come true to seed.

Mulberries, H. H. Hume and F. C. Reimer (*North Carolina Sta. Bul. 194, pp. 39–59, figs. 11*).—This bulletin gives popular directions for the propagation, planting, cultivation, and pruning of mulberries, with descriptions of 15 of the more important varieties.

One of the characteristics claimed for the mulberry is that the fruit ripens over a period of several months. The tree is a rapid grower and the abundance of fruit produced makes it specially useful for planting around stables and chicken and stock yards. As the fruit is greatly relished by birds a few mulberry trees planted in the orchard serves as a protection to other more valuable fruits.

Canning pineapples (*West Indian Bul., 7 (1906), No. 2, pp. 178–185*).—Statistics are given showing the exports of fresh and canned pineapples from the Bahamas, with an account of the methods of canning pineapples followed in Hawaii, the Bahamas, Jamaica, and the Straits and Federated Malay States.

Viticulture in New Zealand, R. Bragato (*New Zeal. Dept. Agr., Vit. Div., 1906, pp. 60, figs. 33*).—This is a handbook for the use of viticulturists in New Zealand, giving detailed directions for the culture of grapes.

Green manuring in tea culture in India, H. H. Mann and C. M. Hutchinson (*Indian Tea Assoc. [Pamphlet] 2, 1906, pp. 43, pls. 10*).—The value of a large number of plants as green manure for tea in India is discussed at length and the results given of experiments made to determine the green manuring value of a few of the more prominent ones.

One of the best of the leguminous trees appears to be the sau (*Albizzia stipulata*). Statistics are given which show that the average yield of tea per bush near sau trees in one instance was 1.7 lbs., while on the same plat farther away from the trees the yield was but 0.8 lb. per bush. In another instance the yield is shown to have been increased 50 per cent when the bushes were grown near sau trees. The good effects of the sau tree are believed to be due in some instances to (1) the light shade that it casts, (2) the retention of the rainfall, (3) the manurial value of the flowers and fallen leaves, (4) the condition of the soil brought about by the extensive and ramifying root system, and (5) the ability of the trees to utilize free nitrogen through the nodules on the roots of the trees.

The root radius of trees 5 years old in one instance was found to be 55 ft., and the depth of the tap root 8½ to 10 ft. Analyses of the soil near sau trees showed a slightly larger percentage of organic matter and a little more nitrogen than in the soil some distance away from the trees. The method of growing this tree on tea plantations, as well as that of the dadap (*Erythrina lithosperma*) and boga-medeloa (*Tephrosia candida*) is given at length.

Another valuable plant for green manuring tea is the bean *Phaseolus mungo*. The increase in yield in tea where this plant has been used has varied from 12 to 16 per cent. The value of such other plants as *Crotolaria striata*, peanuts, mustard, and *Sesbania cannabina* is also discussed.

Treatment of deteriorated tea, H. H. Mann (*Indian Tea Assoc. [Pamphlet] 4, 1906, pp. 24*).—It has been noted that as tea plantations increase with age the quantity of tea obtained is greatly lessened. The author considers the various factors which cause this and gives suggestions on methods of cultivation, pruning, draining, green manuring, and the use of such fertilizers as cattle manure, oil cake, etc., for rejuvenating such old plantations.

Report on a sample of cocoanut "water" from Ceylon, W. R. Dunstan (*Trop. Agr. and Mag. Ceylon Agr. Soc., 26 (1906), No. 5, pp. 377, 378*).—The water in the cocoanut was analyzed with a view to the manufacture of sugar from it should it be found in sufficient quantities. The results of the analyses were as follows: Water, 96 per cent; ash, 0.5 per cent; mannitol, 1.8 per cent; cane sugar, 0.1 per cent; glucose, 0.9 per cent; acid constituents, 0.48 per cent. A sample of water from ripe cocoanuts contained 2.6 per cent of cane sugar, 0.5 per cent of glucose, but no mannitol. Based on these data it is concluded that the manufacture of sugar from cocoanut water is not likely to be profitable, even though the material were a waste product.

Experimental studies on the mechanical effects of frost on fruit and forest trees, P. Sorauer (*Landw. Jahrb., 35 (1906), No. 4, pp. 469–525, pls. 5*).—The details are given of an extensive botanical study to determine the physiological effects of early and late frosts on the mature and immature wood of a large number of fruit and forest trees, including the cherry, pear, apple, rose, linden, elm, beech, horse-chestnut, spruce, and oak. The effect of frost on different wood tissues is shown in numerous plates illustrating cross sections of injured wood.

Among the more important conclusions drawn are the following: The same degree of cold has a different effect on trees, depending on whether the twigs are still young and green or whether they are more nearly ripened and filled with reserve material. In the latter case the effects are chiefly mechanical, and are marked by a discoloration of the cell contents and a browning of the cell walls, while in the former, if the young twigs are not killed outright, the effects are primarily mechanical.

The discolorations occur principally in the cambium and pith of the twigs,

especially in the newest layers of permanent tissue, and affect corresponding zones in the leaf stems. In most woods the thin-walled parenchyma, containing crystals of oxalate of lime, is first affected. The first breaks or openings in the vascular bundles occur either in the region of the hard bast fibers or in the boundary region between the collenchymatous tissues and the endodermis. The spiral vessels are especially susceptible to injury. In the fine veins of the leaves these spiral vessels frequently showed a brown discoloration when the surrounding mesophyll was uninjured.

Frost, however, does not act uniformly. Some of the tissue in the leaf may be brown while the remaining parts are still green. The danger from frost is greatest where the bud is attached, because of the large amount of parenchyma in proportion to the solid ring growth at this place. Frost injury is confined to the region affected and does not spread to new tissue as does a fungus disease.

In addition to discoloration, frost causes many mechanical injuries, and the younger the twigs the greater the amount of such injury. Openings in the leaf and bark surfaces caused by frost are most numerous where the soft parenchyma tissue is united with more solid tissue. Injuries on the upper side of the leaf are generally distinguished by the collenchymatous tissue being split apart from the parenchyma lying underneath.

Eruptions of the vascular cylinder are generally manifested either in radial clefts within the medullary rays or in tangential cracks within the cambium region. In addition, many cavities appear in the pith and the bark parenchyma. The separated tissue within the cambium region gradually heals over, often presenting the appearance of a 2-years' ring growth. Such appearances are most frequently found directly under a bud place.

The permanent wilted appearance of frost-injured twigs is due to the uplifting and splitting of the plant tissue. Leaves which when left on the branch show a wilted condition because the water in the tissue is frozen or has been forced out of the cells regain their normal turgescence on placing the stems in water.

English walnuts in New York, A. C. Pomeroy (*Amer. Agr., 78 (1906), No. 14, pp. 289, 297, figs. 3*).—The author states that in 1876 English walnuts were planted in Niagara County, New York, and that at the present time some of the better trees give an average annual yield of about 20 bu. of nuts. Suggestions are made on the culture of English walnuts and illustrations of the trees and nuts are given.

The pecan and its culture, H. H. Hume (*Petersburg, Va.: Amer. Fruit and Nut Jour., 1906, pp. 159, pls. 10, figs. 38*).—A compact treatise on pecans, treating of the botany, varieties, various cultural operations including harvesting and marketing, and the diseases and insects, the uses of the nuts, and a bibliography of 23 papers on the subject.

Ornamental trees, shrubs, and herbaceous plants in Minnesota, S. B. Green (*Minnesota Sta. Bul. 96, pp. 239–351, figs. 105*).—Brief popular descriptions are given of a large number of ornamental trees, shrubs, and herbaceous plants which can be successfully grown in Minnesota, with some general rules for planting, making lawns, planting for special effects, and winter protection of perennial plants. A prominent feature of the bulletin is the unusually large number of illustrations of different ornamental plants showing their uses for adornment.

FORESTRY.

Chestnut in Connecticut and the improvement of the woodlot, A. F. Hawes (*Connecticut State Sta. Bul. 154, pp. 41, pls. 11, figs. 3*).—"The purpose of this bulletin is to serve as a guide for the better management of our woodlots." Suggestions on making improvement thinning, and tables based

on the stem analyses of over 400 chestnut trees grown in Connecticut, showing the volume in cubic feet and cords of trees of different diameters, and the application of volume tables in estimating the yield of stands are given.

The uses of chestnut for fuel, ties, piles, telegraph and telephone poles, and lumber are discussed, and data given on the relative profits in growing and handling each of these. The cost of cutting, logging, and sawing chestnut lumber is placed at between \$5 and \$6.25 a thousand; of cutting, logging, and sawing ties 15 cts. each; and of hewing ties 10 cts. each. For cutting and peeling piles and poles the cost is usually 1 ct. a linear foot, while the cost of hauling 3 miles varies from 30 to 40 cts. in the case of a 25 ft. pole, to \$3 with a 65 ft. pole. Cordwood costs 90 cts. to \$1.25 a cord for cutting, and from \$1.50 to \$2 a cord for hauling 6 miles.

As to the relative profits of the different forms of timber it is stated that straight trees pay best when cut into poles and lumber pays better than ties or cordwood. Tables are given showing the average height and diameter of sprouts and seedlings of various ages from 20 to 108 years old. The increase in volume of trees varying from 3 to 31 in. in diameter is also shown in tabular form, as well as the average and minimum length of time required for a chestnut tree to produce various numbers of ties.

Relative to the time of cutting the chestnut, the author states that if for fuel alone the trees may be cut when they are 20 in. in diameter. If sound and straight enough for poles they may be profitably left until 25 in. in diameter. A chestnut forest should not be left standing much longer as this is the age at which it reaches its main height growth; it is likely to be attacked by rots and deteriorate if left longer. A table is given showing that both sprouts and seedlings have a larger proportion of diseases as they reach 20 in. and above than before this time.

The sprouting ability of chestnuts seems to be equally good all over the state and to be undiminished through a number of generations. Some data are given showing the value to railroad and other companies, requiring a continuous supply of timber, in establishing permanent forests in Connecticut.

The improved chestnut in lower Austria, E. Böhmerle (*Centbl. Gesam. Forstw., 32 (1906), Nos. 7, pp. 289–306; 8–9, pp. 355–367, figs. 4*).—An account is given of the growth in many different locations of the cultivated chestnut. Statistics showing the diameter measure breast high of stands of different ages, the use of the wood for commercial purposes, and its characteristics green and dry are also considered.

Bassia latifolia gum, P. Shankernath (*Indian Forester, 32 (1906), No. 8, pp. 399–402*).—Analyses of the gum of Mohwa trees indicated that it might be of value as a substitute for Balata, as it has very similar composition and properties. Tapping experiments, however, showed that the amount of gum which can be obtained from the trees is too small to make the working of such trees practicable. It required about 20 mature Mohwa trees to yield 1 lb. of this substitute for gutta-percha. The text contains analyses of 3 samples of the gum.

Practical arboriculture, J. P. Brown (*Connersville, Ind.: Author, 1906, pp. 460, pls. 58, figs. 82*).—This book is made up of a collection of short articles dealing with the various phases of forestry, such as the influence of forests on climates and floods, the planting and care of trees, and the uses of wood for the various purposes of manufacturing, lumber, railroad ties, telegraph poles, wood pulp, etc. The work is of value in calling attention to the importance of forestry, but is in no sense a systematic treatise on the subject.

Forest mensuration, H. S. Graves (*New York: John Wiley & Sons; Lon-*

don: Chapman & Hall, Ltd., 1906, pp. XIV + 458, figs. 55).—This is designed as a text-book for the use of students in forestry and as a reference book for practical foresters and lumbermen. It gives detailed directions for scaling and measuring timber with descriptions of log rules and instruments used in determining the height of trees. Other matters, such as volume tables, form factors, contents of stands, age and growth of trees, yield tables, legislation regarding the measurement of logs, etc., are also included.

Report of the forest seed-testing station at Eberswalde, Schwappach (*Ztschr. Forst u. Jagdw., 38 (1906), No. 8, pp. 505–515, fig. 1*).—A general report is given on the seed-testing work of the station during 3 years, 1903 to 1906.

In the testing of seed of a large number of species of forest trees the germination was considerably more rapid and complete in light than in darkness.

Experiments were made in testing the germination of seeds from trees varying from 20 to 150 years old. The average percentage germination of seed from trees 20 to 40 years old was 70; with trees 80 to 100 years old, 90; with 2 stands of trees 140 years old, 60, and with 1 stand 150 years old, 90. The heaviest seeds were obtained from the oldest trees.

In the test of light *v.* dark-colored seeds, the dark-colored seeds gave much the better germination. A test was also made of the germination of seed stored for different periods but without conclusive results.

Forest seed analyses and control, A. Fron (*Ann. Sci. Agron., 2. ser., 10 (1905), II, No. 3, pp. 332–435, figs. 7; 3. ser., 11 (1906), I, No. 1, pp. 133–153, figs. 22*).—The author treats of the work done in foreign countries in the control and analyses of forest seeds.

The various stations having this work in charge are described and the average results secured with a large number of forest seeds relative to maximum, minimum, and average germination, percentage of purity, etc., are brought together. The technique observed in analyzing and testing the seeds is given with considerable detail and suggestions offered regarding standards which should be observed in making the tests for purity, germination, etc.

The hardness of woods, G. Janka (*Die Härte des Holzes. Vienna: W. Frick, 1906, pp. 32, figs. 7*).—This is a report issued by the forestry experiment station in Mariabrunn, and shows the relative hardness of a large number of different woods when dried and when saturated with water, and in some cases when impregnated with oil. The hardness was determined by pressing into the wood either radially or longitudinally a small iron ball or half-ball. In some instances an iron wedge, a cube, or an ax was inserted. Extensive tables are given showing the results obtained.

Generally speaking the results show that when the tests were made longitudinally the wood was about 30 per cent more difficult of penetration in the case of conifers and 20 per cent more difficult in the case of broad-leaf species than when a radial pressure was applied. Wood which has grown rapidly, as shown by the widths of the annual rings, is less hard than that which is grown more slowly. Likewise, any increase in the specific gravity of wood is followed by an increase in its hardness.

Soaking the wood for 7 months so that it became saturated with water resulted in reducing its hardness in the case of conifers about 50 per cent and in the case of broad-leaf trees 35 per cent. Saturation with oil also decreases the hardness of the wood. It was found that the ax penetrated wood in a slanting manner about 35 per cent easier when the wood was moist than when air-dried.

Forest fires, A. Akerman (*Mass. Forest Serv. Bul. 5, pp. 24*).—The injuries resulting to forests from fires are discussed, and estimates given of the annual

losses in Massachusetts, with suggestions for extinguishing and preventing forest fires. The texts of the Connecticut, Massachusetts, and Minnesota forest-fire laws are given in the appendix.

DISEASES OF PLANTS.

Some fungus diseases of cultivated plants in France, G. DELACROIX (*Extract from Bul. Soc. Mycol. France, 21 (1905), No. 3, pp. 1–23, figs. 6*).—Brief descriptions are given of the occurrence of *Septoria cucurbitacearum* on melon leaves, Septoria on tomatoes, a disease of palms due to *Exosporium palmivorum*, a disease of almonds due to *Fusicoccum amygdali* n. sp., and a disease of oleanders caused by *Phoma oleandrina* n. sp.

Some parasitic fungi of tropical cultivated plants, G. DELACROIX (*Extract from Bul. Soc. Mycol. France, 21 (1905), No. 3, pp. 24–37, figs. 10*).—Among a number of diseases of economic plants that are caused by attacks of parasitic fungi, the author describes the following new species: *Colletotrichum theobromicolum* occurring on the fruit of cacao, *C. brachytrichum* on the leaves of cacao, *Glœosporium mangiferæ* on mango leaves, a number of species of fungi on rubber trees, *Glomerella artocarpi* on bread fruit, *Diplodia perseana* on the avocado, and *Phyllosticta cinnamomi* on the leaves of cinnamon.

Blight and powdery mildew of peas, J. M. VAN HOOK (*Ohio Sta. Bul. 173, pp. 231–249, figs. 12*).—After an introductory note by the botanist of the station calling attention to the presence and injury due to these diseases on a crop of peas grown for canning purposes, a description is given of the different diseases and their causes, together with suggestions for their prevention.

The blighting of field and garden peas is due to the fungus *Ascochyta pisi*, and from the author's investigation it was found that the infection spreads largely through the use of diseased seed. Having determined this fact a series of experiments was carried on to test the germination of peas affected with the blight fungus and also the effect of seed treatment and the value of spraying and tying up the vines as preventives. Seed treatment proved valueless, as the fungus is less susceptible to fungicides than the germ of the seed. For a similar reason heating the seed failed. Tying up the vines and spraying, while increasing the crop slightly produced peas that were much freer from disease than others and on that account are valuable in growing healthy peas for seed purposes.

Planting healthy peas in soil free from fungus is recommended as the best means of reducing the loss of blight. The author states that the fungus causing pea blight is known also to attack alfalfa, chick-peas, common beans, and hairy vetch. All varieties of the common bean examined were affected, but some much more than others.

In the note on the powdery mildew (*Erysiphe communis*), the author states that by spraying with Bordeaux mixture the disease may be readily prevented.

Anthracnose of beans and peas, H. BLIN (*Rev. Hort. [Paris], 78 (1906), No. 14, pp. 335–337*).—Descriptions are given of the anthracnose of beans due to *Colletotrichum lindemuthianum* and of peas caused by *Ascochyta pisi*, with suggestions for their prevention. In experiments carried on in 1901 and 1903 in which beans were thoroughly sprayed with Bordeaux mixture, relatively little disease was observed, and the author thinks that a similar treatment would be efficient in preventing the anthracnose of peas.

A disease of ginseng due to Phytophthora, J. M. VAN HOOK (*Spec. Crops, n. ser., 5 (1906), No. 45, p. 94*).—The author describes a disease of ginseng which is due to *Phytophthora omnivora*. The fungus is very common on many

plants and has been observed on many specimens of ginseng submitted for examination.

The author recommends the destruction of all dead plants, spraying with Bordeaux mixture, and frequent changing of location as far as possible or sterilization of soil. In spraying, particular attention must be paid to covering the petioles and stem in the region of the fork, as this seems to be the portion of the plant most subject to attack.

Diseases of beets and mangels, G. MASSEE (*Roy. Bot. Gard. Kew, Bul. Misc. Inform., 1906, No. 3, pp. 49-60, figs. 5*).—Notes are given on a number of diseases to which beets and mangels are subject, among them beet canker, beet rust, leaf spot, mildew, root rot, beet-root tumor, white rust, scab, heart rot, etc. Among the diseases described which are relatively little known in this country are the beet canker, due to *Pionnotes betæ*, and the heart rot, caused by *Sphærella tabifica*.

The canker attacks beets and mangels in storage, particularly if the roots have undergone a period of sweating. The fungus causes dingy yellow spots that appear on the surface of the roots. These soon spread, forming irregular nodular gelatinous crusts, involving more or less of the root, until the whole is disorganized and destroyed. The fungus also attacks potatoes, as the author has proved by numerous inoculation experiments, and he believes it is identical with that which has been described as *P. rhizophila*, which is said to attack potatoes and dahlias. The author suggests care in storing, so that the roots should be thoroughly dry, and that every precaution should be taken to prevent sweating in storage.

The heart rot, which has been reported as destructive in some localities, usually manifests itself in August, when the roots have attained a fairly large size. The first indication of its presence is seen in the drooping of the large outside leaves. The appearance is somewhat similar to that of wilting due to lack of moisture, but the leaves do not regain their upright position during the night, and an examination shows a considerable portion of the upper surface of the leaf stalks bleached and studded with minute black points. The fungus grows downward, entering the crown of the root, which is eventually killed. In this destruction the fungus is frequently aided by other fungi, bacteria, nematodes, etc. When symptoms of this disease appear, all affected roots should be pulled and burned or deeply buried.

Perpetuation of potato rot and leaf curl, G. MASSEE (*Roy. Bot. Gard. Kew. Bul. Misc. Inform., 1906, No. 4, pp. 111, 112*).—A description is given of experiments to show the means by which the potato rot (*Phytophthora infestans*) and the leaf curl (*Macrosporium solani*) are perpetuated. Attention is called to the frequent sudden appearance of these diseases and the fact that fields are often destroyed within 24 hours. This widespread destruction has led to an investigation of means of dissemination other than by spores to account for this epidemic form of disease.

The author took a number of diseased tubers, cut them in halves, and planted them in pots, placing the pots under conditions where the temperature, atmosphere, and soil moisture could be controlled. The plants grown in cool, well-lighted, dry houses showed no trace of disease at the end of 2 months, but when one of the plants was removed to a warm house and placed under a bell jar it was blackened and killed by the fungus within 9 days. Similarly marked results were obtained by using potato tubers infested with the Macrosporium, showing that this fungus can also be perpetuated by hybernating mycelium present in the tubers.

The experiments seem to indicate that the fungus may be present, but held in

abeyance by atmospheric conditions. When a number of warm, damp days of dull weather intervene the fungus, already present in the tissues, develops with great rapidity. It is believed that the two diseases will not occur in an aggressive form when the climatic conditions are unfavorable to their development.

The root rots of sugar beets, L. Peters (*Ber. Deut. Bot. Gesell., 24 (1906), No. 6, pp. 323–329*).—Attention is called to the fact that a number of fungi are concerned in the diseases commonly referred to as beet root rot, and the author describes the characteristic effects produced by *Pythium debaryanum* and *Phoma betæ*. In addition to these fungi he states that *Aphanomyces lævis* must be considered as causing a form of rot of sugar-beet roots. Specific differences in the action of these fungi are pointed out.

Top rot of sugar cane (*Queensland Agr. Jour., 16 (1906), No. 8, pp. 498–505*).—A summary is given of investigations on the top rot of sugar cane, a disease which has been known in Australia for a number of years. In some seasons nearly the whole crop has been a failure, while in other cases the reduction in yield has amounted to over 20 to 50 per cent.

The disease can be first recognized near the center of the heart of the young sprout. The leaves at this very early stage of the disease are paler than the ordinary color, and the heart becomes a yellowish brown, while the expanding leaves are thinner than usual, somewhat dry, and slightly curled. The appearance of the different parts of the cane plant as affected by this disease is described, and the liability of different varieties to disease is considered.

The changes shown in the early symptoms of the disease seem to be the consequence of chemical processes, as neither fungi nor bacteria are to be found in the earliest infected parts of the plant. The chemical changes effect disorganization and death of the plant cells, and the wounds thus made are invaded by various kinds of fungi and bacteria. Various other theories have been advanced as to the cause of the disease, but the author believes that it is due to chemical changes, possibly induced through atmospheric and soil conditions.

Investigations on some diseases of tobacco in France, G. Delacroix (*Extract from Ann. Inst. Nat. Agron., 2. ser., 5 (1906), No. 1, pp. 92, figs. 17*).—Extended descriptions are given of a bacterial canker of tobacco due to *Bacillus æruginosus*, several bacterial diseases which follow insect injuries, the mosaic disease of tobacco, leaf spot disease caused by *Bacillus maculicola*, a root rot due to *Fusarium tabacivorum*, a sclerotium disease, several leaf rusts, albinism, chlorosis, etc. The symptoms of the diseases are noted, the organisms, so far as known, are technically described, and the results of inoculation experiments in establishing the causes of the diseases are stated. Brief bibliographies are given of literature relating to each disease and, where known, preventive treatments are recommended.

Tobacco wilt in South Africa, C. P. Lounsbury (*Agr. Jour. Cape Good Hope, 28 (1906), No. 6, pp. 784–803, figs. 9*).—The author describes a disease of tobacco which is attributed to the potato moth or leaf miner (*Gelechia operculella*). This disease is in some respects quite similar to the wilt of tobacco, as described from this country and from Japan. Notes on these two diseases are appended.

A new fungus of economic importance, R. E. Smith and Elizabeth H. Smith (*Bot. Gaz., 42 (1906), No. 3, pp. 215–221, figs. 3*).—Among the investigations that are being carried on by the California Experiment Station is that on a destructive rotting of lemons which occurs in southern California and within a few years has become a serious trouble to lemon growers and shippers. The rot is usually called brown rot to distinguish it from the blue mold

or Penicillium rot. The affected lemons are easily distinguished from those attacked by the blue mold, although the latter fungus rapidly follows the other and soon covers the decaying fruit. The odor of the lemons affected by the brown rot is characteristic, and the peculiar rancid smell can be quickly detected by an experienced person.

When brown rot first made its appearance in packing houses, search was made in the orchard to locate the origin of the trouble, and lemons showing a brownish discolored area on the side or end without any decided softening of the rind were found on the trees. The affected fruit keeps its size, shape, and solidity for a considerable time, when it usually falls to the ground.

Under the conditions of lemon packing this fungus finds its way into the boxes and spots develop on fruit that are apparently sound when put away. The diseased fruits are soon involved together with all those which lie in contact with them. The trouble never spreads in the mass of stored fruit except by actual contact of the healthy lemon with an affected spot. When a large amount of fruit becomes affected, the characteristic odor is very pronounced.

A study was made of the fungus and inoculation experiments showed that it was the cause of the disease. The investigations of the authors showed that it is a hitherto unrecognized fungus which has relationship with a number of genera. Both the genus and species are believed to be new and the organism is described as *Pythiacystis citrophthora*.

A bulletin from the California Station on the nature and control of the disease is promised in the near future.

Revision of the genus Hemileia, G. MASSEE (*Roy. Bot. Gard. Kew, Bul. Misc. Inform., 1906, No. 2, pp. 35–42, pl. 1*).—The author calls attention to the lack of information regarding the æcidial stages of species of Hemileia, and suggests that as there are known to be species of Æcidium on plants that are also infested by Hemileia, probably a form of heterœcism exists in this genus, and that the solution of this problem would be of value in attempts to check the ravages of the parasitic form. He notes also that *Hemileia vastatrix* has been reported as occurring in various regions upon the indigenous species of Coffea, and he thinks that it is not necessary to assume that the coffee disease has always been imported with coffee plants from one country to another.

Suggestions are given for the prevention of spread of the disease, and until the æcidial stage is known it is believed that where the nature of the ground and other circumstances permit of spraying, the use of half-normal strengths of Bordeaux mixture is advisable. A note is given from an observer in Tonkin stating that the spread of the disease seems to be checked by the removal of coffee shade.

The author gives amended descriptions of the genera and species, describing 4 species of Hemileia, of which *H. vastatrix* and *H. woodii* are known to occur parasitically upon coffee. *H. vastatrix*, which is widely known as exceedingly destructive to coffee, has been reported as occurring in Ceylon, India, China, Java, Sumatra, Singapore, the Philippine Islands, Samoa, Fiji, Mauritius, Madagascar, and numerous places in Africa. *H. woodii* is indigenous in the southern part of Africa on species of Coffea and also on species of Vangueria, while in Java and Queensland it occurs on gardenias.

A bibliography of the more important contributions relating to the Hemileia disease of coffee is appended.

Diseases of coffee with particular reference to Hemileia vastatrix, BUIS (*Agr. Prat. Pays Chauds, 6 (1906), No. 42, pp. 228–247, figs. 2*).—Notes are given on the ravages of *Hemileia vastatrix* in Ceylon, Madagascar, Réunion, etc.,

and attention is called to various means that have been tried to combat it. These include the destruction of the affected foliage, spraying and fumigating diseased plants, the influence of location on the disease, resistant varieties, etc.

Spraying was found to be effective under certain conditions, but it is often so expensive as not to be economically advantageous. Liberian coffee and some Java and other hybrids seem to be quite resistant, so far as the author's investigations have been carried. Improved culture seems to be valuable in rendering the plants less liable to injury. Where Arabian varieties are grown, the plantings should not be made in situations where there is too great humidity and heat. The trees should be artificially irrigated where there is a lack of rainfall, selection made of vigorous plants from the nursery, and attention paid to the choice of fertilizers and the keeping down of weeds.

An effective treatment for grape anthracnose, C. P. Lounsbury (*Agr. Jour. Cape Good Hope, 29 (1906), No. 1, pp. 29–35, fig. 1*).—After briefly describing grape anthracnose, due to *Glœosporium ampelophagum*, the author calls attention to the varying susceptibility of different varieties to this disease and points out the almost complete resistance of a number of forms. For the prevention of the disease winter treatment with an acid solution of iron sulphate is recommended, and an account is given of experiments in which a vineyard was treated with this solution. Vines that had suffered severely the year before, when given the treatment bore a heavy crop of fruit and but occasional evidences could be found of the presence of any disease in the vineyards.

Investigations on the development of Botrytis cinerea, J. M. Guillon (*Compt. Rend. Acad. Sci. [Paris], 142 (1906), No. 24, pp. 1346–1349*).—The author has studied the development of *Botrytis cinerea*, which causes the gray rot of grapes, and has endeavored to ascertain its method of rapid spreading.

Inoculation experiments made upon wounded grapes showed that the spores develop rapidly and in from 36 hours to 3 days are able to cause a pronounced infection. In other experiments it is shown that the Botrytis developing normally in contact with uninjured grapes is able to penetrate the epidermis of the fruit and set up an infection within a relatively short time. It is also found that the fungus by its mycelium is able to spread from place to place, so that grapes not immediately in contact are readily infected, even if the spread of the spores by means of the air should be disregarded.

Notes on the grape powdery mildew, P. Pacottet (*Rev. Vit., 26 (1906), No. 655, pp. 9–13*).—Attention is called to the perithecial phase of the powdery mildew.

The author believes that the perithecia are formed annually in France in different places and that they play a very important part in the spread of the disease. A number of localities are mentioned in which the perithecial stage is commonly produced, and there seems to be indicated a direct relationship between the autumnal temperature and rainfall and the development of the perithecia. For the prevention of the destructive spread of the disease, attention to these centers is recommended and the perithecia destroyed as far as possible.

Combined treatment against downy and powdery mildew, L. Vernet (*Prog. Agr. et Vit. (Ed. l'Est), 27 (1906), No. 19, p. 557*).—For combating these 2 diseases of grapes the author recommends spraying with a 2 per cent solution of Bordeaux mixture, 4 applications to be given the vines, and it is suggested that immediately following the first and third applications the vines be dusted with a mixture of equal parts of sublimed sulphur and

gypsum or sulphate of lime. The addition of the sulphate of lime is said to favor the transformation of the copper hydrate, makes the solutions more adherent, and favors the better distribution of the sulphur.

The pathological respiration of grape leaves attacked by downy mildew, L. Pavarino (*Atti Ist. Bot. Univ. Pavia, 2. ser., 11 (1906), p. 16; abs. in Bot. Centbl., 102 (1906), No. 28, pp. 38, 39*).—The effect of Peronospora on the respiration of grape leaves was studied and found to exert a marked influence on the normal respiration, as well as the intramolecular respiration of the leaves. The normal respiration is greatly accelerated by the downy mildew and the intramolecular respiration is much more active in diseased leaves.

On investigating the presence of ferments in both diseased and normal leaves, the author found that the diseased leaves contained much greater quantities of oxidase than normal and that the same is true for injured leaves or nonparasitic diseases. These oxidases he does not believe are directly produced by the parasites, but are the result of a reaction of the protoplasm of the plant when contiguous to the parasite or to some poisonous substances excreted by the parasites. He believes that the oxidizing ferments which are found in various organs of the grape attacked by Peronospora are a cause of the disease of wine known as "casse."

The gooseberry mildew in Europe, its spread and prevention, J. Eriksson (*Ztschr. Pflanzenkrank., 16 (1906), No. 2, pp. 83–90, pls. 2, map 1*).—An account is given of the occurrence and distribution of the gooseberry mildew (*Sphærotheca mors-uvæ*) in which the author mentions its appearance in different countries and indicates later stations of its occurrence. The life history of the fungus is described and brief suggestions given for its control, A brief bibliography is appended.

Notes on Glœosporium ribis, H. Klebahn (*Ztschr. Pflanzenkrank., 16 (1906), No. 2, pp. 65–83, pls. 2*).—In his studies on some of the imperfect fungi, the author has carried on experiments with *Glœosporium ribis*, and from his investigations he is led to recognize its ascospore stage. This stage he describes as *Pseudopeziza ribis* n. sp., and inoculation experiments have shown that this fungus and the conidial form are related.

Studies on Glœosporium, P. Viala and P. Pacottet (*Ann. Inst. Nat. Agron., 2. ser., 5 (1906), No. 1, pp. 31–83, figs. 42*).—Studies are reported on *Glœosporium nervisequum*, the cause of the sycamore anthracnose, in which the yeast-like and cyst reproductive bodies are described.

Notes are also given on some similar bodies observed in *Ascochyta pisi*. A description is included of the cultural changes and methods employed in the investigations.

Notes on leaf blight of sycamore, J. Beauverie (*Compt. Rend. Acad. Sci. [Paris], 142 (1906), No. 26, pp. 1551–1554*).—A description is given of the leaf blight of the sycamore due to *Glœosporium nervisequum* or *Gnomonia veneta*, particular attention being called to its occurrence in nurseries. In some parts of France this fungus has been exceedingly destructive, especially on young seedlings, and preventive treatments are suggested.

Cortinarius as a mycorrhiza-producing fungus, C. H. Kauffman (*Bot. Gaz., 42 (1906), No. 3, pp. 208–214, fig. 1*).—According to the author, while considerable attention has been paid endotrophic mycorrhiza, the fungi which cause ectotrophic mycorrhiza have not been investigated except in a very few cases. Some investigation is needed to determine the fungi causing mycorrhiza in order to determine some of the problems which have to do with its physiological action.

The author had observed that specimens of Cortinarius were constantly found

in limited areas in such close proximity to certain trees that there appeared to be some connection between them, and subsequent examinations showed that a species of Cortinarius was associated with red oaks, maples, and climbing bitter sweet (*Celastrus scandens*). This species of fungus, it was observed, is characterized by its brick-red mycelial strands and stem, and microscopical examinations showed that it formed truly ectotrophic mycorrhiza. A discussion is given of the fungus and its relation to the host plants. The species, which has been determined as new, is described under the name *Cortinarius rubipes*.

Studies in root parasitism, C. A. BARBER (*Mem. Dept. Agr. India, Bot. Ser., 1 (1906), No. 1, pp. 30, pls. 7*).—Studies are reported on the root parasitism of the sandalwood tree (*Santalum album*).

Attention has been drawn to the sandalwood tree during recent years on account of the occurrence of a serious disease, and it was thought worth while to make a careful study of the root system with reference to its possible bearing on it. In addition doubt has been cast on the extent of the root parasitism. The author has therefore made a study of the haustoria of the sandalwood tree, paying particular attention to the early stages up to the time when they penetrate the woody tissues of the host plant.

In addition to the parasitic sandalwood, for which over 100 host plants have been found, studies were made of a number of other allied species. The various tissues of the host and its parasite are described at considerable length, and a second paper is promised to deal with the structure of the mature haustorium.

The witch broom disease in Surinam, C. J. J. VAN HALL (*Trop. Life, 2 (1906), No. 6, p. 83*).—The witches' broom disease of cacao is said to be widely spread in Surinam, the disease in places proving a very serious one, inasmuch as it attacks not only the trees, but also the pods. The infested pods exhibit black spots, which spread rapidly, the pods remaining small and deformed. In some cases fully 50 per cent are practically destroyed. Upon the twigs the disease does not seem to be so serious, and the author believes that if the pods can be kept in a healthy condition considerable progress will be made in checking the disease.

To get rid of the disease, experiments are now being carried on in pruning the trees thoroughly, following this by good tillage of the soil, and also spraying with Bordeaux mixture. These experiments have not yet been sufficiently pursued to warrant any definite conclusions, but the indications are that the amount of injury may be decidedly reduced by these treatments.

A fungus attacking the roots of Para rubber, H. N. RIDLEY (*Agr. Bul. Straits and Fed. Malay States, 5 (1906), No. 3, pp. 64, 65*).—The author reports having received from a number of localities rubber trees that were attacked by some fungus which appeared different from *Fomes semitostus*. The specimens were all young trees about 2 in. in diameter, and the roots were encrusted with a white mycelium. The trees were dead; if left alone the trees die within about 3 weeks after the first appearance of the disease. The fungus appears to be some member of the Polyporeæ, and the attack quite similar to that which has been noted on clove trees, coffee, etc.

The biology of Polyporus squamosus, A. H. R. BULLER (*Jour. Econ. Biol., 1 (1906), No. 3, pp. 101–138, pls. 5, figs. 6*).—After some general remarks on the destruction of wood by fungi and a review of literature, the author describes his investigations on the destruction of the wood of the sycamore maple by *Polyporus squamosus*.

So far as the author's knowledge goes, this fungus has never been observed on any coniferous tree, but it attacks numerous species of maple, oak, elm,

hazel, walnut, linden, ash, willow, birch, etc. The fruiting bodies of the fungus are described, and it is said that when a tree has been killed by *P. squamosus* the fungus may continue its annual production of fruiting bodies for a considerable period. In this case the fungus is considered saprophytic, and in the case of its appearance on posts, flag poles, etc., it is believed that the infection took place when the trees were living, although under favorable conditions the dead wood might become attacked.

Notes are given on the spore characters of the fungus, experiments on their germination, vegetative growth, etc., after which the changes induced in the wood are described, particular attention being paid to the chemical changes which are brought about by the fungus. Analyses of sound and decayed wood show marked differences in the carbon content, the carbonizing of the wood amounting to an increase of at least 2 per cent of the dry material.

In the study made the author found evidence of the action of enzyms produced by the fungus. Altogether there appeared to be 8 or 10 different enzyms occurring in the fruiting bodies. Among those noted were laccase, tyrosinase, amylase, emulsin, protease, lipase, rennetase, "coagulase," etc.

Attempts were made to develop the fruiting bodies from pure cultures, but while a dense mat of mycelium was secured, no signs of fruiting bodies made their appearance.

The common fungus and insect pests of growing vegetable crops, W. Lochhead and T. D. Jarvis (*Ontario Agr. Col. and Expt. Farm Bul. 150, pp. 34, figs. 35*).—Popular descriptions are given of the diseases of plants which are caused by fungi, slime molds, and insects, and where known the remedies are described. A chapter is given on the preparation and application of fungicides and insecticides.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Distribution and migration of North American ducks, geese, and swans, W. W. Cooke (*U. S. Dept. Agr., Biol. Survey Bul. 26, pp. 90*).—Of the 64 recognized species of ducks, geese, and swans in North America north of Mexico, 24 breed in the United States. Of these the most important species are considered as being wood duck, mallard, black duck, teal, canvasback, redhead, and Canada goose.

The effect of inadequate protection for water fowl is seen most strikingly in the case of the wood duck, which has suffered greatly in some localities. The protection of ducks, geese, and swans in order to be effective must be in force particularly at the breeding season, during migration, and in the winter. The striking diminution in numbers of some of the species is largely due to unsportsmanlike slaughter at times when they are least able to escape.

One of the most important winter homes of North American ducks and geese is the State of California. An elaborate account is presented of the distribution and migration of these species and detailed notes are given on the breeding range, winter range, spring migration, and fall migration of each of the species and subspecies recognized in North America.

The North American eagles and their economic relations, H. C. Oberholser (*U. S. Dept. Agr., Biol. Survey Bul. 27, pp. 31, pls. 2, figs. 2*).—The economic relations of eagles are somewhat difficult to determine on account of the fact that they feed upon many rodents and other noxious small mammals, but also destroy game birds, water fowl, lambs, poultry, and other useful animals. In the author's opinion eagles are therefore to be considered about neutral in economic influence.

A detailed account is given of the general habits, food, and economic status of the golden eagle, gray sea eagle, and bald eagle. In the case of each one of these species its distribution and the extent of its destruction by man are mentioned.

The economic relations of seed crows as based on an examination of stomach contents during a period of 11 years, M. HOLLRUNG (*Landw. Jahrb., 35 (1906), No. 4, pp. 579–620, fig. 1*).—During the years 1895 to 1905, inclusive, the stomachs of seed crows were examined for the purpose of learning their feeding habits. Many inquiries were made personally and through agricultural newspapers with regard to this question in parts of the Province of Saxony.

The material at the disposal of the author was unusually extensive and a careful examination was made of about 4,000 stomachs of these birds. It appears that the seed crows are omnivorous, feeding upon seeds, animals, various kinds of waste material, and mineral matter. Occasionally the birds are charged with killing young hare and injuring cereals. Barley, oats, rye, wheat, corn, buckwheat, and other vegetable material were found in the stomachs of the seed crows. On the other hand, the birds destroyed cockchafers, wireworms, various caterpillars, and snout beetles which are injurious to cultivated crops. Under ordinary conditions, therefore, it is believed that the destruction of seed crows is not justified.

Birds as conservators of the forest, F. E. L. BEAL (*N. Y. State Forest, Fish and Game Com. Ann. Rpt., 8–9 (1902–3), pp. 236–274, pls. 14, figs. 2*).—In this article particular attention is given to a discussion of the habits of birds which spend a large part of their time in forest trees. The benefits derived from the destruction of forest insects by these birds are mentioned and notes are also given on the injury caused to trees by a destruction of buds. The birds studied in this connection include woodpeckers, titmice, creepers, warblers, cuckoos, etc.

The squirrels and other rodents of the Adirondacks, F. C. PAULMIER (*N. Y. State Forest, Fish and Game Com. Ann. Rpt., 8–9 (1902–3), pp. 335–351, pls. 4*).—In the State of New York, 28 species of rodents are recognized. In the present article brief notes are given on the habits of the more conspicuous species with particular reference to their food and economic relations.

Destruction of rats and mice in fields, C. MACÍAS (*Com. Par. Agr. [Mexico], Circ. 41, pp. 25, figs. 28*).—Brief notes are given on the injuries caused by various species of mice to cultivated crops. A number of formulas are given for the preparation of poisoned baits to destroy these pests and suggestions are made regarding a great variety of traps also used for this purpose.

Notes on the destruction of injurious vermin, C. M. JOHNSTON (*Orange River Colony Dept. Agr., Biol. Div. Leaflet 1, pp. 7*).—In eradicating jackals strychnin is the drug which is most commonly used in poisonous baits. At present, however, it is more difficult to induce the jackals to eat the bait than was formerly the case.

Notes are given on the methods of preparing poisonous baits and on the use of traps and other methods for destroying rabbits, baboons, and grain-eating birds.

The frog book, MARY C. DICKERSON (*New York: Doubleday, Page & Co., 1906, pp. XVII+253, pls. 112, figs. 35*).—The biology and feeding habits of North American spadefoot toads, common toads, tree frogs, and frogs are given together with elaborate descriptions of the appearance of the various species. The economic relations of frogs and toads are discussed and notes are given on the nature of their food. The illustrations of the different species are of unusual excellence.

Third annual report of the State entomologist, R. A. Cooley (*Montana Sta. Bul. 62, pp. 181–230, pls. 4, figs. 4*).—This report is occupied with a general account of the codling moth, plum gouger, bollworm, and white-lined morning sphinx.

The codling moth is now distributed locally in the main fruit-growing regions of Montana, and the author believes that it can not be exterminated. Recommendations are made of methods calculated to control the insect in infested localities.

The plum gouger has a local distribution in the State at present and attacks only native varieties of plums. During 1905 the bollworm did considerable damage to corn in various parts of the State. Some alarm was felt by alfalfa growers over the unusual prevalence of the white-lined morning sphinx. The author believes, however, that this insect was feeding mostly on weeds and only to a slight extent on cultivated plants.

Report of the chief inspector of nurseries and orchards, A. F. Burgess (*Ohio Dept. Agr., Div. Nursery and Orchard Insp. Rpt. 1905, pp. 45*).—The author discusses the extent of nursery inspection during the year, the number of trees infested with San José scale and other injurious pests, fumigation of nursery stock, orchard inspection, and other routine work of the inspector's office. An account is also presented of cankerworm, plum curculio, codling moth, grape-berry moth, elm-leaf beetle, catalpa sphinx, and other injurious insects. Brief notes are given on methods of spraying for various insect pests and on the use of K-L mixtures, Con-Sol, and other insecticides.

The monthly bulletin of the division of zoology, H. A. Surface (*Penn. Dept. Agr., Mo. Bul. Div. Zool., 4 (1906), No. 1, pp. 40, figs. 2*).—Notes are given on experiments with asparagus beetles. Spraying with lead arsenate and resin soap gave good results. A list is also presented, with formulas, for the preparation of standard insecticides and fungicides, together with notes on the special treatment of a number of the more common injurious insects.

The monthly bulletin of the division of zoology, H. A. Surface (*Penn. Dept. Agr., Mo. Bul. Div. Zool., 4 (1906), No. 2, pp. 43–80, pls. 9*).—A brief account is given of the use of whale-oil soap, kerosene emulsion, and lime-and-sulphur wash in combating the oyster-shell scale, scurfy scale, and San José scale. The greater part of the bulletin is occupied by a systematic description of Hemiptera.

The monthly bulletin of the division of zoology, H. A. Surface (*Penn. Dept. Agr., Mo. Bul. Div. Zool., 4 (1906), No. 3, pp. 82–112, pls. 4*).—In experiments with insecticides for controlling oyster-shell bark-louse good results were obtained with whale-oil soap and kerosene emulsion. Notes are given on summer treatment of scale insects, ants, fall webworms, flies, red spiders, grain weevil, and other insect pests.

Index-catalogue of medical and veterinary zoology, C. W. Stiles and A. Hassall (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 39, pts. 14, pp. 951–1044; 15, pp. 1045–1116; 16, pp. 1117–1208*).—In continuation of the index of medical and veterinary zoology these parts contain the names of authors from Laache to Lyutkevich.

Report of the secretary of the Louisiana crop pest commission, 1904–5, W. Newell (*Crop Pest Com. La. Circ. 7, pp. 27*).—Brief statements are presented regarding boll-weevil quarantine in Louisiana, experiments with cultural methods, Paris green, and other means of controlling the boll weevil, together with notes on the San José scale, nursery and orchard inspection, cattle ticks, horseflies, and orange insects.

Injurious insects and other animals observed in Ireland during the year

1905, G. H. CARPENTER (*Econ. Proc. Roy. Dublin Soc., 1 (1906), No. 8, pp. 321–344, pls. 5, figs. 8*).—Notes are given on nematode worms, cabbage aphis, diamond-back moth, slugs, gooseberry sawfly, wireworms, rice weevil, and various other insects affecting cultivated crops and trees.

In combating slugs, dressings of salt or lime have usually been found most effective. The cabbage aphis may be controlled in small gardens by spraying with kerosene emulsion. Attention is called to the importance of attacking this insect at its earliest appearance.

Entomological inspection report, A. CRAW (*Hawaii. Forester and Agr., 3 (1906), No. 6, pp. 187–189*).—A brief account is given of the extent of importation of fruits, vegetables, and various plants and of the inspection made on such material. During this inspection of more than 19,000 packages, many cases of serious infestation were discovered, and infested plants or fruits were fumigated or destroyed.

Notes on insect swarms on mountain tops in New Zealand, G. V. HUDSON (*Trans. and Proc. New Zeal. Inst., 38 (1905), pp. 334–336*).—Some of the commonest species of insects in New Zealand were observed in large swarms on mountain tops at elevations of 4,000 to 7,200 ft. In some cases ladybirds were noticed in immense quantities at high elevations where there is no vegetation and where plant lice could hardly have been present to serve as food.

Seasonable notes on some orchard pests, G. QUINN (*Jour. Dept. Agr. So. Aust., 10 (1906), No. 1, pp. 9–14*).—Biological and economic notes are given on the codling moth, oyster-shell bark-louse, black peach aphis, plum curculio, peach leaf curl, and apple scab.

The entomological section, C. B. SIMPSON (*Transvaal Agr. Jour., 4 (1906), No. 16, pp. 839–853, pl. 1, fig. 1*).—The life history and nest-building habits of white ants are described. In destroying these insects the best results have been obtained from the use of an apparatus by means of which fumes from a heated mixture containing 1 part sulphur and 9 parts arsenic are pumped directly into the nest. A brief statement is also made regarding locust control.

Report of the government entomologist for the half year ended Dec. 31, 1904, C. P. LOUNSBURY (*Cape Good Hope Dept. Agr., Rpt. Govt. Ent. 1904, pt. 2, pp. 12*).—During the period under report particular attention was given to experiments with dips for the destruction of ticks, investigation of grape diseases, and the regulation of the importation of plants. Arsenite of soda was found to possess great value as a tick destroyer. This remedy was tested on a number of farms and was found to be as efficient without the addition of tar as when this material was added. C. W. Mally also presents a brief report on locust destruction, fruit fly, and cornstalk borer.

Report of the government entomologist for the year 1905, C. P. LOUNSBURY (*Cape Good Hope Dept. Agr., Rpt. Govt. Ent. 1905, pp. 95–104*).—The work of the year was concerned largely with a study of the transmission of animal diseases by ticks, the natural enemies of the fruit fly, cornstalk borer, locust destruction, codling moth, and nursery inspection. Little hope is expressed for the successful control of the fruit fly or codling moth by means of insects. Considerable attention is now being given to the establishment of Capri figs in Cape Colony for the purpose of introducing the fig wasp, which will assist in fertilizing Smyrna figs.

Some notable instances of the distribution of injurious insects by artificial means, F. V. THEOBALD (*Sci. Prog. Twentieth Cent., 1 (1906), No. 1, pp. 58–72, figs. 3*).—A large number of examples are mentioned of injurious insects which have been carried from their original home to other parts of the same country or other countries in food products or as a result of the extensive

development of international commerce. In this connection particular mention is made of the codling moth, fruit flies, scale insects, woolly aphis, pear midge, Colorado potato beetle, Hessian fly, and sheep scab mite.

Cold storage as a factor in the spread of insect pests, C. FULLER (*Natal Agr. Jour. and Min. Rec., 9 (1906), No. 7, p. 656*).—The author had occasion to observe that the fruit-fly maggots may remain alive in peaches kept in cold storage at a temperature of 39° to 40° F. for a period of at least 121 days.

Report of the economic zoologist on cotton insects, L. ICHES (*Bol. Min. Agr. [Buenos Ayres], 5 (1906), No. 3, pp. 273–320*).—The author made a study of the insect pests of cotton in Chaco, particular attention being given to *Prodenia ornithogalli* and *Aletia xylina*. In combating the lepidopterous pests of cotton good success was had from the use of Paris green or arsenic in the proportion of 1 part to 50 parts of flour. Paris green as well as white arsenic was also used in a fluid form.

The boll weevil. Information concerning its life history and habits, W. NEWELL (*Crop Pest Com. La. Circ. 9, pp. 29, figs. 15*).—A summary is presented of the life history and habits of the boll weevil in its different stages and the means by which it is disseminated, its migration, hibernation, and other matters connected with an understanding of its history.

Report of the executive committee upon the Paris green experiments conducted against the boll weevil during 1905, B. W. MARSTON, L. S. FRIERSON, and W. NEWELL (*Crop Pest Com. La. Circ. 8, pp. 31, figs. 4*).—A test was made of Paris green as a means of controlling the cotton-boll weevil. This remedy was applied to cotton kept under large wire-screen cages and under field conditions.

The season was unfavorable to the work on account of the late development of cotton and other difficulties met with in applying Paris green at the most effective period. When Paris green was applied at the rate of $10\frac{3}{4}$ lbs. per acre in 4 applications nearly all of the boll weevils were destroyed, and the insects were greatly reduced in number by the use of $2\frac{7}{8}$ lbs. of Paris green per acre. The use of the large quantity of Paris green resulted in considerable injury to the cotton and a diminished yield.

The general conclusion reached from this series of experiments is that Paris green may be applied to cotton that is blooming and squaring in such a way as to reduce the number of boll weevils, but the injury to cotton is quite serious. It is suggested that during average seasons better results may be obtained since Paris green could be applied earlier.

The tobacco splitworm, an enemy of tomato, eggplant, and poha in Hawaii, J. KOTINSKY (*Hawaii. Forester and Agr., 3 (1906), No. 7, pp. 200, 201*).—*Phthorimaea operculella* is reported as causing considerable injury to tomatoes, eggplants, and the cape gooseberry in Hawaii. A number of parasites are known to prey upon this pest. The artificial remedies suggested by the author include clean cultivation, the removal of all rubbish from cultivated fields, and careful attention to the fertility of the soil.

An outbreak of locusts, A. C. TONNELIER (*Bol. Min. Agr. [Buenos Ayres], 5 (1906), No. 3, pp. 328–356, figs. 33*).—The injuries caused by large swarms of locusts are described and notes are given on practical remedies for combating them. These include the use of barriers and driving by means of brooms and branches.

The locust mite, T. D. JARVIS (*Canad. Ent., 38 (1906), No. 10, pp. 349, 350, figs. 2*).—*Trombidium locustarum* was very common during the season, especially on the red-legged locust. A brief account is given of the appearance and habits of this parasite.

Cicadula sexnotata and its control, J. R. Jungner (*Arb. Deut. Landw. Gesell., 1906, No. 115, pp. 50, pl. 1, figs. 3, dgm. 1*).—This insect is well known throughout Germany as the cause of great injury to grasses, cereals, and certain legumes.

The habits and life history of the species are described in considerable detail. According to the author, a number of other insects are associated with it in attacking cultivated crops, and parasitic fungi in some cases become located on the plants as a result of its attacks. A number of insects and birds prey upon *Cicadula sexnotata*, but the insect is not sufficiently controlled by natural means.

In combating the pest, fields of grain may be protected by plowing furrows around them in which running water is maintained or which are covered with a film of oil. Badly infested grass lands may be burned over in the fall, and considerable benefit is derived from suitable systems of rotation.

Hairy caterpillar pests of crops, H. Maxwell Lefroy (*Agr. Jour. India, 1 (1906), No. 3, pp. 187–191, pl. 1*).—The habits and life history of a number of caterpillars in India are briefly outlined. Attention is called to the desirability of recognizing all such pests in the early stages, since insecticides applied at this time are far more effective.

Hyponomeuta malinella, L. Dassonville (*Bul. Agr. Algérie et Tunisie, 12 (1906), No. 14, pp. 298–300, fig. 1*).—The caterpillar of this insect is one of the most serious pests of apple trees in the region of Âin-Touta, but experiments have shown that it may be readily controlled by the use of arsenate of lead. Directions are given for preparing this insecticide.

Pear and cherry-tree slug, L. J. Newman (*Jour. Dept. Agr. West. Aust., 14 (1906), No. 2, pp. 109–111, fig. 1*).—The habits and life history of this pest are briefly described. As remedies in controlling the insect the author suggests dry air-slaked lime, white hellebore, Paris green, kerosene emulsion, benzole, and Bordeaux mixture.

Important notes on the gypsy and brown-tail moths, A. E. Stene (*Off. Comr. Suppression Gypsy and Brown-tail Moths [R. I.], Circ. 1, pp. 14, pls. 4*).—A copy is given of the recent Rhode Island law regarding the extermination of these pests and providing for the appointment of a commissioner to have charge of the work. Brief notes are given on the life history of the pests and on methods for controlling them.

The gypsy and brown-tail moths, E. P. Felt (*N. Y. State Mus. Bul. 103, pp. 42, pls. 10*).—On account of the unusual interest manifested at present in the control of the gypsy and brown-tail moths, the author presents a general account of the appearance, habits, life history, and most effective means of combating these pests.

The fruit fly and its parasites, A. Hempel (*Bol. Agr. [São Paulo], 7. ser., 1906, No. 5, pp. 206–214*).—A brief historical statement is given concerning the investigations conducted by various entomologists in the neighborhood of Bahia in search of parasites of *Ceratitis capitata*. A number of such parasites have been found and have been kept under the observation of the author for the purpose of determining their economic importance.

As a result of this study it is concluded that parasites can not be depended upon to furnish much assistance in controlling the pest, and fruit growers are urged to continue the usual methods of control.

The spread of the fruit fly (Ceratitis capitata) in the neighborhood of Paris, A. Giard (*Compt. Rend. Acad. Sci. [Paris], 143 (1906), No. 8, pp. 353, 354*).—The author called attention to the presence of the fruit fly about Paris six years ago, but little effort has been put forth to control this pest. In the meantime it has gradually increased and is doing considerable damage.

The orange-tree butterfly, C. W. Howard (*Transvaal Agr. Jour., 4 (1906), No. 16, pp. 727–732, pl. 1*).—The appearance and life history of *Papilio demoleus* are briefly outlined. This pest may be controlled by spraying with Paris green at the rate of 1 lb. to 200 gal. of water.

Internal parasites of Diaspis pentagona, A. Berlese (*Bol. Uffic. Min. Agr., Indus. e Com. [Rome], 4 (1906), No. 7, pp. 663, 664*).—*Diaspis pentagona* is recognized as a serious pest of mulberries, and some attention is being given to the encouragement of parasites of this insect.

On the parasites of Diaspis pentagona, L. O. Howard (*Ent. News, 17 (1906), No. 8, pp. 291–293, fig. 1*).—*D. pentagona* has been known in the District of Columbia since 1892, and an opportunity has, therefore, been had to study rather closely its insect parasites. A number of infested scale have been sent to Italy in the hope that beneficial parasites might be reared from them to assist in combating the pest in that country. A considerable number of parasites have been reared, one of which is described as new under the name *Prospalta berlesei.*

The mango weevil (Cryptorhynchus mangiferæ), D. L. Van Dine (*Hawaii Sta. Press Bul. 17, pp. 11, pls. 2*).—The injury done by the mango weevil to the seeds of mangoes was first noted last year and the pest has already become a serious one. Apparently it has been introduced into Hawaii some time since 1898.

The habits and life history of the pest are briefly described. The weevil undergoes its entire development within the seed and can not, therefore, be treated by ordinary insecticides. It is stated that the destruction of rubbish about the trees during the period from October to March will kill many of the hibernating weevils. It is also recommended that neglected trees along the wayside be destroyed.

The oyster-shell bark-louse, G. Quinn (*Jour. Dept. Agr. So. Aust., 8 (1905), No. 11, pp. 639–647, figs. 3*).—It is not known when the oyster-shell bark-louse was first introduced into South Australia, but apparently it has been present for many years. A detailed account is given of the life history of this insect and the injuries which it produces.

In spraying for the pest the author recommends the use of lime-sulphur-salt wash, various resin compounds, kerosene emulsion, and red oil emulsion. The last-named insecticide is made of 1 lb. soap, 1 gal. red oil, and 1 gal. soft water, the mixture being diluted before spraying to 14 to 16 gal.

The oyster-shell bark-louse, T. D. Jarvis (*Canad. Ent., 38 (1906), No. 9, pp. 289–294, figs. 3*).—The appearance, habits, and life history of this insect are briefly discussed by way of comparison with scurfy scale and San José scale. While a number of efficient remedies are known for this pest, the best results have followed the use of lime-sulphur-salt wash.

A new species of fungus parasitic on Ceroplastes rusci, A. Berlese (*Redia, 3 (1906), No. 41, pp. 166–168*).—In western Africa, particularly in Dahomey, a scale insect was observed in large numbers on the cocoanut palm which proved to be *Aspidiotus destructor*. A mixture containing soda and resin is recommended as a spray for this pest.

A new species of fungus parasitic on ceroplastes rusci, A. Berlese (*Redia, 3 (1905), No. 1, pp. 8–15, pl. 1, figs. 3*).—In the body cavity and various organs of a number of scale insects, including *Ceroplastes rusci*, fungus bodies are found resembling yeast cells. The fungus is described as new under the name *Oospora saccardiana.*

Ladybirds and woolly aphis, D. L. Breen (*Jour. Dept. Agr. West. Aust., 13 (1906), No. 5, p. 447*).—*Leis conformis* was introduced from Tasmania and

liberated in apple orchards badly infested with woolly aphis. The ladybird in question has shown itself to be very efficient, having practically annihilated the woolly aphis on the majority of the apple trees. A number of native ladybirds are beneficial.

The mite disease of grapevines, H. Müller-Thurgau (*Centbl. Bakt.* [*etc.*], *2. Abt., 15 (1905), No. 19–20, pp. 623–629, figs. 2*).—The disease caused by this mite was at first not understood. Since the discovery of the mite, however, successful remedies have been devised. The remedies suggested by the author include spraying with a 4 per cent solution of lysol, a 3 per cent solution of soda, or a 1 per cent solution of carbolic acid. Badly infested parts may be removed and destroyed.

Winter treatment for acariosis of grapes, H. Faes (*Chron. Agr. Vaud, 19 (1906), No. 3, pp. 43–49, pl. 1*).—Lysol in 4 per cent solution gave excellent results in laboratory tests. It moistened the wood instantly and penetrated into all cracks, killing the mites promptly. A mixture containing 3 per cent black soap and 1 per cent carbolic acid gave results about equal to those obtained with lysol. A 30 per cent solution of iron to which 1 per cent sulphuric acid was added was effective in destroying the mites, but did not spread so readily as lysol.

Margorodes vitium, J. M. Huergo (*Bol. Min. Agr.* [*Buenos Ayres*], *5 (1906), No. 3, pp. 321–325*).—This insect causes great damage to grapes, but in some cases it appears that the injury attributed to it has been caused by nematode root worms and other diseases.

The insects affecting the black locust and hardy catalpa, E. C. Cotton (*Ohio Dept. Agr., Div. Nursery and Orchard Insp. Bul. 7, pp. 55, figs. 11*).—On account of the increased demand for black locust as railroad ties and for similar purposes, the study of its insect pests assumes considerable importance. This tree is seriously attacked by a number of pests, the most important of which is the locust borer. The insect injury is exceedingly serious, particularly on account of the fact that it is not readily detected in the early stages of attack. Detailed notes are given on the habits, life history, and injuries caused by the locust borer, locust carpenter moth, *Odontota dorsalis*, *Ecdytolopha insiticiana*, *Crepidodera rufipes*, *Apion nigrum*, locust sawfly, San José scale, Cecropia moth, and numerous other species which injure the locust more or less.

The hardy catalpa is much less seriously attacked by insect pests. The author discusses the more serious of these enemies, including *Ceratomia catalpæ*, *Cecidomyia catalpæ*, fall webworm, white grubs, and other insects.

Elm-leaf beetle, V. Mayet (*Prog. Agr. et Vit. (Ed. l'Est), 27 (1906), No. 25, pp. 725–728, pl. 1*).—An account is given of the habits, natural enemies, and means of combating this pest. A large number of insects prey upon it, but these are not sufficient to hold it in check. Spraying with arsenicals is a satisfactory treatment.

Injuries to trees by insects, G. Cecconi (*Staz. Sper. Agr. Ital., 38 (1905), No. 10–12, pp. 865–905, pls. 7*).—Particular attention is given in this article to an account of the life history, habits, and injurious attacks of white ants and various species of moths, beetles, and other insects which injure forest trees.

Two enemies of Juniperus communis, V. Torka (*Naturw. Ztschr. Land u. Forstw., 4 (1906), No. 9, pp. 399–404, figs. 5*).—While the common cedar is not considered of much value in Germany, it has nevertheless been found necessary to devote some attention to its insect enemies. The author presents notes on the habits, life history, and injurious attacks of *Phlœosinus thujæ* and *Callidium castaneum*.

A note on the life history of Hoplocerambyx spinicornis, E. P. Stebbing

(*Calcutta: Supt. Govt. Printing, India, 1906, pp. 16, pls. 3*).—Sal trees are largely used for railroad ties in India, and this wood has been so badly injured by the attacks of *H. spinicornis* that large quantities of ties have had to be rejected. The full-grown larvæ are found in the wood in February and the beetles appear and are seen on the wing from May until July. The tunnels of the larvæ penetrate into the heart of the tree. The only way of combating the pest successfully appears to be the drastic method of cutting out infested trees and charring the outside so as to kill all larvæ.

Synopsis of Portuguese galls and gall insects, J. S. TAVARES (*Brotéria, 4 (1905), pp. V–XII + 1–123, pls. 14*).—A brief bibliography relating to the galls of Portugal is presented and an elaborate tabulation is given of the gall insects found upon various trees and herbaceous plants in Portugal.

Studies on South American termites, N. HOLMGREN (*Zool. Jahrb., Abt. System., Geogr. u. Biol. Tiere, 23 (1906), No. 5, pp. 521–676, figs. 81*).—A detailed descriptive account is presented of various species of white ants known to occur in South America. Many of these species are described as new.

Notes are given on the biology of white ants with special reference to the forms of the individuals and the construction of their nests. A bibliography of the subject is also presented.

Habits and peculiarities of some South African ticks, C. P. LOUNSBURY (*Cape Town: Govt., 1905, pp. 10*).—A number of ticks are known to cause serious injury to farm animals in Cape Colony, aside from their agency in carrying diseases. The author has given particular attention in his investigations to *Amblyomma hebræum*, *Argas persicus*, *Ixodes pilosus*, and various species of Rhipicephalus and Boophilus. Attention is called to the fact that our knowledge of the life history of ticks is very meager. The author reared the different species through as many stages as possible and presents data as to the time occupied by the ticks in different stages, and other details of their life history.

A new enemy of common fowls, A. HEMPEL (*Bol. Agr. [São Paulo] 7. ser., 1906, No. 6, pp. 259–261*).—*Argas reflexus* is known to be a parasite on pigeons and the author has observed a number of instances in which young chickens and adult fowls were infested by it. The remedies usually adopted against *A. persicus* will doubtless be of avail against this pest.

Studies on Culex and Anopheles, B. GALLI-VALERIO and JEANNE ROCHAZ-DE JONGH (*Atti Soc. Studi Malaria, 7 (1906), pp. 1–17*).—The author presents in a tabular form data relating to the time of appearance of various species of mosquitoes and the temperature and other climatic conditions which prevailed.

In a study of the natural enemies of mosquitoes it was found that *Triton cristatus* and *T. muticellus* are quite influential in the destruction of the mosquito larvæ and nymphs. Further studies were made with reference to the action of the spores of *Aspergillus niger* and *A. glaucus* on mosquitoes. *A. niger* was found to exercise a very prejudicial effect on the development of mosquitoes and in general the presence of the spores of these fungi in water infested with mosquito larvæ is believed to check their multiplication to an appreciable extent.

A new mosquito killer (*Municipal Jour. and Engin., 21 (1906), No. 14, pp. 335, 336*).—A by-product obtained in the manufacture of turpentine by the fractional distillation of pine wood has been tested in the destruction of mosquitoes and has been found to be very effective, possessing certain advantages over sulphur. The material is a liquid which can be readily volatilized by the application of heat and a current of air over the heated surface. The fumes are, therefore, generated outside of the room to be fumigated and then conducted into

this room. The material costs about the same as sulphur, requires only 1 hour for treatment as compared with 2 hours with sulphur, does not injure metals, fabrics, paint, or color, and is not particularly irritating or harmful to human beings.

Mites affecting farm homesteads, T. D. JARVIS (*Canad. Ent., 38 (1906), No. 7, pp. 239–241*).—A description is given of a serious infestation of a house with *Tyroglyphus longior*. The mites occurred in large numbers and collected on clothing and other articles. The house was tightly closed and fumigated with hydrocyanic-acid gas, using 24 oz. of cyanid to 1,000 cu. ft. The treatment proved quite effective and apparently destroyed all of the mites.

Cockroaches, W. W. FROGGATT (*Agr. Gaz. N. S. Wales, 17 (1906), No. 5, pp. 440–447, pl. 1*).—The author describes several of the common species of cockroaches in New South Wales and presents a brief account of practical methods for controlling the pest. The methods include the use of phosphorus paste, borax, gunpowder, bisulphid of carbon, and hydrocyanic acid.

The reaction of insects toward formalin fumes, K. LAMPERT (*Ztschr. Wiss. Insektenbiol., 2 (1906), No. 1, pp. 12, 13*).—On the occasion of fumigating a house after an outbreak of scarlet fever the author placed a number of insects in open glass vessels and other situations to note the influence of formalin fumes upon them. The fumigation was prolonged for 4 hours. The insects used in this experiment were cockroaches, spiders, larvæ of wasps, etc. None of the insects were affected by the formalin fumes. The author believes, therefore, that formalin is not adapted for the destruction of insects in houses.

Destruction of insects in greenhouses by hydrocyanic acid, L. TILLIER (*Jour. Agr. Prat., n. ser., 12 (1906), No. 32, pp. 181, 182, fig. 1*).—The use of hydrocyanic acid in destroying insects in greenhouses is becoming more generally practiced in France. For this purpose a special apparatus is illustrated and recommended. For ordinary greenhouse work the author suggests the use of 2.5 gm. of potassium cyanid for a cubic meter of space.

Arsenate of lead, C. P. LOUNSBURY (*Agr. Jour. Cape Good Hope, 29 (1906), No. 2, pp. 223–228*).—The author states that arrangements have finally been made by which an excellent quality of arsenate of lead may be obtained in Cape Colony. This insecticide is recommended as superior to Paris green or any other arsenical poison for use against the codling moth and most leaf-eating insects.

Spraying to control or prevent injury from insects and plant diseases, R. I. SMITH (*Ga. Bd. Ent. Bul. 19, pp. 127–168, figs. 3*).—A general statement is given regarding the importance of spraying and the use of insecticides and fungicides.

The main part of the bulletin is occupied with formulas for preparing and directions for applying a standard insecticide and fungicide. A spray calendar is also given recommending applications for the more common injurious insects and fungus diseases.

Apiculture, R. HOMMELL (*Apiculture. Paris: J. B. Baillière & Son, 1906, pp. XII+542, figs. 178*).—This volume is one of a series which will constitute an agricultural encyclopedia published under the direction of G. Wery. The whole subject of bee raising is discussed in detail. The subject-matter of the volume is arranged under the following heads: Anatomy and physiology of bees, biology of bee colonies, wax, nectar, honey, bee plants, structure of beehives, management of bees, extraction of honey, utilization of all bee products, and the various enemies of bees.

Bees and the corolla of flowers, F. FAIDEAU (*Apiculteur, 50 (1906), Nos. 3, pp. 98–107, figs. 5; 5–6, pp. 195–203, figs. 5*).—A study was made of the

influence exerted by the color and odor of flowers upon the visits of bees in the collection of honey and other bee foods. The author comes to the conclusion, as the result of this observation, that the odor of flowers is a much more important factor in attracting bees than is the color or shape of the corolla.

FOODS—HUMAN NUTRITION.

Concerning the behavior in the body of certain organic and inorganic phosphorus compounds, F. W. TUNNICLIFFE (*Arch. Internat. Pharmacod. et Thér., 16 (1906), No. 1–4, pp. 207–220*).—Using 2 children as subjects, a comparison was made of an organic phosphorus body (a compound of glycerophosphoric acid and pure casein) and an inorganic body, calcium phosphate, the special object of the experiments being to determine whether by increasing the phosphorus of the diet it is possible to increase the amount of phosphorus retained in the body and to observe the effects of inorganic and organic phosphorus compounds upon proteid metabolism.

The balance of income and outgo of nitrogen was determined in the experimental periods and in the fore and after periods. The conclusions which were drawn are, in effect, as follows:

In the healthy child the addition of an organic phosphorus compound to the diet was followed by an increase in the amount of phosphorus assimilated by and retained in the body. An organic phosphorus compound increases the amount of nitrogen of the food assimilated. The addition of calcium phosphate to the food did not increase the amount of phosphorus assimilated or retained by the child, nor did this compound exert any favorable influence upon the assimilation of the nitrogen of the food. The phosphorus contained in the sodium glycero-phosphate of casein is practically entirely assimilated by the body.

The article contains a summary and discussion of data regarding the more or less complicated organic phosphorus compounds which are regarded partly as foods and partly as medicines which "have found extensive therapeutic use and seem to be gradually replacing the older inorganic phosphates."

The value of experiments on the metabolism of protein, E. ABDERHALDEN (*Zentbl. Gesam. Physiol. u. Path. Stoffwechsels, n. ser., 1 (1906), No. 18, pp. 561–565*).—A critical discussion of recent studies of proteids. The author believes that a knowledge of cell metabolism may be gained by biological and chemical methods.

Progress of proteid cleavage on different diets, H. VOGT (*Beitr. Chem. Physiol. u. Path., 8 (1906), No. 11–12, pp. 409–430, figs. 5*).—Studies with men and dogs, in most of which the proportion of nitrogen and phosphoric acid in the urine was determined at hourly intervals after the ingestion of food, showed that the rate of digestion varied with different proteids.

The author points out that when the cleavage curves of different foods and combinations are known, together with the factors dependent upon them, some satisfactory theories can be formulated regarding diet in health and especially in disease.

Proteid substances in muscle, M. SOAVE (*Atti R. Accad. Sci. Torino, 40, No. 13, p. 831; abs. in Zentbl. Physiol., 20 (1906), No. 12, p. 394*).—Analyses showed that beef muscle and rabbit muscle contained about the same proportions each of histidin, arginin, and lysin. Quite different proportions were found in myosin and myogen. Ammonia nitrogen was also found in myogen but not in myosin. According to the author, at least one of the hexon bases, namely arginin, must exist in muscle in a free state or at all events in a compound which is not an integral part of the muscle proteid.

The present knowledge regarding fat considered from a physiological-chemical standpoint, A. JOLLES (*Umschau, 10 (1906), No. 40, pp. 795, 796*).—A summary of data regarding the structure of fat, its cleavage in the body, forms in which fat is assimilated, lecithin and its compounds, and similar topics. The author points out that fat is excreted in the human body through the skin, the urine, and the feces, and that the total amount excreted per week varies according to the individual, the temperature of the atmosphere, the work performed, and other factors, for instance, being greater when severe work is performed in a warm temperature than when the temperature is cool and no work is performed.

Mercers' Company lectures on recent advances in the physiology of digestion, E. H. STARLING (*London: Archibald Constable & Co., Ltd., 1906, pp. 156; rev. in Brit. Med. Jour., 1906, No. 2387, pp. 781, 782*).—The work of other investigators has been included in this general summary, as well as that of the author and his collaborators.

Some of the questions considered are the changes which food stuffs undergo in the process of digestion, the rate of change, the factors which cause cleavage to cease, digestive ferments, and the mechanism of the movements of different parts of the digestive tract.

Influence of chocolate and coffee on uric acid, P. FAUVEL (*Compt. Rend. Acad. Sci. [Paris], 142 (1906), No. 25, pp. 1428–1430*).—The excretion of purin bases in the urine was increased by the methyl xanthins of chocolate and coffee, while the uric acid excretion was unchanged. The precipitation of uric acid by acids was prevented. In the author's opinion, the influence of the bodies present in chocolate and coffee, especially theobromin, is less pernicious than that exerted by the purin bodies of meat and leguminous vegetables.

Notes on purin-free diets, W. A. POTTS (*Lancet [London], 1906, II, No. 14, pp. 933–936, fig. 1*).—Basing his argument on the contention that it is desirable for persons in health, as well as those suffering from various diseases, to subsist on a purin-free diet, different foods and food combinations are discussed, and some arguments are presented for a fruitarian diet. The so-called nutritive value of a number of foods is shown graphically, but apparently the data represent simply total dry matter.

Sailors' food, W. SPOONER (*Brit. Med. Jour., 1906, No. 2388, pp. 862–864*).—Information is summarized regarding the rations provided for British sailors, the disadvantages of the usual ration pointed out, and changes suggested. To secure needed variety the use of various simple foodstuffs from time to time is recommended, and a table is given showing quantities which are considered equivalent.

Vegetarianism (*Dietet. and Hyg. Gaz., 22 (1906), No. 9, pp. 535, 536*).—Some popular fallacies regarding vegetarian diet are pointed out.

As regards the possible transmission of disease from animal and vegetable foods, the following statement is made: "If meats are well cooked and vegetables carefully cleaned, the dangers from disease-producing bacteria will be reduced to a minimum."

A new variety of bread (*Pure Products, 2 (1906), No. 7, pp. 383–386*).—A form of bread made in Europe is described in which the clean moistened grain is allowed to malt until germination begins, then crushed and ground until it is fine, and made into dough. Both rye and wheat are used for this sort of bread.

The solanin content of potatoes, M. WINTGEN (*Arch. Pharm., 244 (1906), No. 5, pp. 360–372*).—From the author's investigations the conclusion was reached that the solanin content of potatoes varies markedly with different

varieties, but in general is lower than the average figures ordinarily quoted. No increase in the solanin content of stored potatoes was noted when the sprouts were removed. It was found that diseased potatoes possessed no higher solanin content than sound potatoes, nor did it appear that bacteria increased the solanin content.

A biological method of separating cassava starch, E. de Kruijff (*Teysmannia, 17 (1906), No. 8, pp. 503–508*).—In comparative tests the author found that it was possible to obtain a larger yield of cassava starch by biological than by mechanical methods. The biological method consisted in allowing bacteria to destroy the cell walls and free the starch.

The amount of iron in spinach, H. Serger (*Pharm. Ztg., 51 (1906), No. 33, p. 372*).—Four samples of spinach containing from 86.7 to 89.5 per cent water showed on an average 0.104 per cent iron on the dry-matter basis. The proportion of iron in alcohol extract of spinach and related topics was also studied.

Candle-nut oil (*Agr. Gaz. N. S. Wales, 17 (1906), No. 8, pp. 859, 860*).—An analysis of candle-nut, the fruit of *Aleurites triloba*, is reported. The proportion of fat is 59.93 per cent. In the author's opinion 55 per cent of the oil could be readily extracted commercially.

The nutritive value of fish, G. Rosenfeld (*Zentbl. Inn. Med., 27 (1906), No. 7, pp. 169–176*).—From the standpoint of both nutritive value and palatability fish is an important food and in the author's opinion, based on experiments, equal to beef as a source of energy in the diet. It produces the same sensation of satiety and this lasts for a long time. Fish causes the excretion of a smaller amount of uric acid than meat.

Loss of material when fish is cooked, A. Beythien (*Pharm. Centralhalle, 47 (1906), p. 140; abs. in Zentbl. Gesam. Physiol. u. Path. Stoffwechsels, n. ser., 1 (1906), No. 17, p. 560*).—The experiments reported showed that the water in which fish was boiled contained 8.8 to 11.3 per cent of the total fish protein. As the water could not be used for food purposes on account of its odor this represents a waste.

A cook book for nurses, Sarah C. Hill (*Boston: Whitcomb & Barrows, 1906; rev. in Dietet. and Hyg. Gaz., 22 (1906), No. 9, p. 576*).—The author has brought together recipes of dishes identical in method of cooking and differing only in one or two ingredients, and discusses such topics as fluid diet, light soft diet, convalescent diet, and diets suited to a number of special diseases.

Foods and food control, W. D. Bigelow and C. H. Greathouse (*U. S. Dept. Agr., Bur. Chem. Bul. 69, rev. ed., pt. 9, pp. VI + 705–778*).—A digest which serves as an index of the compilations of laws regarding food and food control previously noted (E. S. R., 17, p. 891).

Food adulteration, F. W. Traphagen (*Montana Sta. Bul. 61, pp. 135–180*).—Information regarding the effects of food preservatives and similar questions is summarized and the results of the examination of a number of samples of catsups, jams, jellies, canned goods, and other foods and food products reported. Of the samples examined 101 were found to be adulterated as compared with 143 in which no adulteration was found.

A warning regarding the use of chemical preservatives in meats, E. F. Ladd (*North Dakota Sta. Spec. Bul. 2, pp. 7*).—The requirements of the State pure-food law with respect to meat and meat products are pointed out, and attention is directed to the fact that the laws are to be strictly enforced. Data are also reported regarding the examination of a sample of strained honey and 3 samples of preserves, all of which were adulterated or sophisticated.

Preservatives in food and food examination, J. C. Thresh and A. E.

Porter (*London: J. & A. Churchill, 1906, pp. 484; rev. in Pub. Health* [*London*], *19* (*1906*), *No. 1, pp. 53, 54*).—This volume contains chapters on preservatives, artificial coloring matters, unsound food, the sophistication of food and its detection, and related questions.

Review of the literature of composition, analysis, and adulteration of foods for the year 1905, A. J. J. Vandevelde and M. Henseval (*Separate from Bul. Serv. Surveill. Fabric. et Com. Denrées Aliment., 1906, pp. 120*).—The subjects included are general articles, apparatus, water, milk and cream, fats and oils, cheese, cereals and cereal products, spices, sugar, sirup, etc., vinegar, fruits and vegetables, adulteration, and similar topics. In many cases the bibliographical data are supplemented by short abstracts. For earlier work see E. S. R., 17, p. 787.

ANIMAL PRODUCTION.

Cattle feeding experiments, H. R. Smith (*Nebraska Sta. Bul. 93, pp. 23, fig. 1*).—Continuing earlier work (E. S. R., 17, p. 688) the relative merits of different sorts of coarse fodder for supplementing corn and the value of different concentrated feeds as compared with alfalfa were studied with 6 lots of 10 steers each.

In the first test the rations consisted of snapped corn with prairie hay and with corn stover, each alone and with equal parts of alfalfa hay, snapped corn, and alfalfa hay, and with corn fodder (entire plant and ears) and alfalfa hay. In the 12 weeks covered by the period the average daily gain per steer ranged from 1.02 lbs. on snapped corn and corn stover to 2.06 lbs. on snapped corn and alfalfa hay. The greatest range in grain consumed per pound of gain was also noticed with these lots, being 4.6 lbs. on the alfalfa hay ration and 9.25 lbs. on the corn stover ration. The greatest amount of coarse fodder per pound of gain, 22.44 lbs., was also noticed with the last-mentioned lot, and the smallest amount, 10.47 lbs., with the lot fed prairie hay and alfalfa hay with snapped corn. Gain was most cheaply made on snapped corn with corn stover and alfalfa hay, costing 5.01 cts., and was dearest on snapped corn and prairie hay, costing 8.76 cts. per pound.

The steers were followed by pigs, and the value of the pork produced, as a by-product for each pound of gain made by the steers ranged from 0.7 cts. with the snapped corn, prairie hay, and alfalfa hay to 1.18 cts. on the snapped corn and prairie hay ration.

As pointed out by the author, in each of the 4 lots where alfalfa, a coarse fodder rich in protein, was used, the gains were larger than in the other cases and were made on less feed and at a lower cost. Feeding alfalfa with prairie hay 1 : 1 as compared with prairie hay effected a saving of 40 per cent of the corn required per pound of gain and 47 per cent when fed with corn stover as compared with stover without alfalfa. "The larger saving of corn in the case of stover was no doubt due in part to the fact that stover is more deficient in protein than is prairie hay." The amount of feed wasted "was very slight in case of alfalfa and very considerable with the corn stover. From one-third to one-half of the lower part of the cornstalk was thrown out because of its being refused by the cattle."

"Alfalfa hay is pronouncedly superior to prairie hay for beef production, and the more rapid the extension of the area of land devoted to the production of alfalfa, supplanting the less valuable and lower yielding native hay, the more rapid will be the production of wealth from our soil.

"Native prairie hay, if for any reason it is most available for feeding purposes, should not be fed with corn alone, but rather with corn supplemented

with a small quantity of some protein food, such as oil meal, to give more nearly a balance of nutrients in keeping with animal requirements.

"Cornstalks cut and put in the shock immediately after the ears ripen possess a food value which can not consistently be ignored by the farmer, and existing land values warrant the larger utilization of this roughness by the adoption of methods of harvesting that will make such material more valuable for feeding purposes."

After an interval of 3 weeks the cattle used in the preceding test were again subdivided into 6 lots of 10 steers each. Corn alone, corn and bran 3:1, and corn with oil meal and with cotton-seed meal 9:1, with prairie grass hay in every case, were compared, as well as corn and corn-and-cob meal each with alfalfa hay and prairie hay 1:1. The feeding period covered 8 weeks. The average daily gain ranged from 1.27 lbs. per head on corn and prairie hay to 2.52 lbs. on corn and oil meal. The grain eaten per pound of gain ranged from 9.77 lbs. on both the corn and oil meal and the corn-and-cob meal and alfalfa hay rations to 15.10 lbs. on corn, and the hay eaten from 2.7 lbs. on corn and oil meal to 3.94 lbs. on corn. The cost of a pound of gain was largest with the last-mentioned lot, being 10.74 cts., and lowest, 7.4 cts., with the lot fed corn and alfalfa hay.

Pigs followed the steers, and the value of the pork produced as a by-product to each pound of gain made by the steers ranged from 0.68 ct. in the case of the corn and cotton-seed meal ration to 2.05 cts. in the case of the corn ration.

"Conclusions can not be drawn from the results of a single experiment, but the records of this test indicate that oil meal is superior to cotton-seed meal. The greater profits, however, from oil meal were due in part to the fact that the hogs behind the cattle fed cotton-seed meal made much smaller gains.

"The records in this experiment also indicate that oil meal has a value nearly three times as great as bran. . . .

"None of the protein concentrates proved as cheap as alfalfa hay."

Our available stock foods, W. H. Dalrymple (*Louisiana Stas. Bul. 86, pp. 74, figs. 11*).—Available data regarding the composition and nutritive value of a number of feeding stuffs, especially those of local origin, are spoken of, and sample rations for different farm animals are suggested in which such feeding stuffs are used.

Requests for information regarding the feeding of low-grade sugar cane molasses or blackstrap were sent to a number of planters. Opinions regarding its use were not entirely uniform, but in general they showed that this material was extensively used and very favorably regarded. The consumption of molasses per head per day on 47 sugar estates averaged about 10 lbs., the range being from 2 or 3 lbs. to a little over 21 lbs. The majority of those supplying information conceded that molasses effected a saving of 10 to 50 per cent in feed bills. The opinion was generally advanced that feeding molasses diminished the number of cases of dietetic ailments, such as colic, etc., and improved the health and therefore the capacity of the animals for work.

"Some feed molasses as an ingredient of a mixed ration; others, by itself, ad libitum, in an open receptacle; while still others adopt both methods. . . . The fewer number of planters feed their animals 3 times per day, the majority twice."

In a number of cases the replies received stated that molasses was fed to all classes of farm animals except poultry as well as to horses and mules.

Value of ground maize cobs, R. H. Gennys (*Agr. Gaz. N. S. Wales, 17 (1906), No. 5, pp. 475, 476, fig. 1*).—Data are summarized regarding the composition and feeding value of corn-and-cob meal, and a test briefly noted in which

somewhat shriveled and immature corn ears, having no market value, were coarsely ground and the corn-and-cob meal fed to 11 pigs for 21 weeks. The ration consisted entirely of the corn-and-cob meal mixed with water. The calculated profit was about $56. Farm horses were also fed on corn-and-cob meal with chaff. "They were at work fairly hard during the period and held their own well."

Utilization of fresh pea pods and asparagus waste, A. MÜLLER (*Konserv. Ztg., 1906, p. 40; abs. in Chem. Ztg., 30 (1906), No. 72, Repert. No. 30, p. 295*).—With a view to determining their feeding value the author made analyses of the asparagus waste and the fresh pea pods which accumulate at canneries.

The asparagus waste contained, on a dry matter basis, 5.99 per cent water, 20.97 per cent protein, 2.00 per cent fat, 37.13 per cent nitrogen-free extract, 25.84 per cent crude fiber, and 7.99 per cent ash, and the pea pods 7.88 per cent water, 16.00 per cent protein, 1.25 per cent fat, 50.69 per cent nitrogen-free extract, 18.85 per cent crude fiber, and 5.33 per cent ash.

Potato drying in Germany, PAROW (*Mitt. Deut. Landw. Gesell., 21 (1906), No. 25, pp. 264-266*).—When potatoes can not be otherwise utilized it is stated that they may be dried and used as a feeding stuff. Information is given regarding the method and cost of drying and the value of the dried product.

Concerning the poisonous properties of peanut cake, F. SCHMIDT (*Chem. Ztg., 30 (1906), No. 73, p. 882*).—The author attributes the harmful effects sometimes noted after feeding peanut cake principally to the presence of sand. Fermentation, bacterial growth, and adulteration with castor beans are also regarded as causes.

A native plant recommended as a fodder for the dry country, J. H. MAIDEN (*Agr. Gaz. N. S. Wales, 17 (1906), No. 7, p. 719*).—A brief note to the effect that the Noogoora bur (*Sida corrugata*, var. *trichopoda*) is valuable as a fodder plant. It is said that sheep fatten quickly on it and that cattle relish it, but that horses do not care much for it.

Concerning the nutritive value of amid substances, B. VON STRUSIEWICZ (*Inaug. Diss. Univ. Göttingen [1906]; abs. in Jour. Landw., 54 (1906), No. 1, p. 81*).—Feeding experiments with sheep to study the nutritive value of the amid substances in beets and beet molasses led to the conclusions that such material is fully equal to digestible protein, and that in estimates of the nutritive value of feeding stuffs the amid nitrogen should not be subtracted from the digestible protein and reckoned with the nitrogen-free extract.

Sheep and saltbushes, Coolabah farm, R. W. PEACOCK (*Agr. Gaz. N. S. Wales, 17 (1906), No. 7, pp. 701-707, figs. 3*).—On saltbush alone, 5 sheep fed in a pen lost 3.2 lbs. per head in a year's feeding period, but were apparently healthy, while sheep fed on saltbush supplemented with hay, grass, green feed, etc., gained 12.5 lbs. each during the same time. Six sheep running in a saltbush paddock for a year gained on an average 11.17 lbs. each. Feeding saltbush diminished the yield of wool somewhat, but the fleece was of good quality. The saltbush mutton was dry and tough, resembling mutton produced during time of drought, but the flavor was sweet. "Very little fat was on inside—the kidneys were just covered with a thin film; also paunch." The value of the different varieties of saltbushes may perhaps be gauged by the partiality of the sheep for them. The following varieties were fed: *Atriplex nummularia, A. vesicaria, A. angulata, A. semibaccata*, and *A. leptocarpa*, the first mentioned being the chief feed throughout the test. "They relished a change from one variety to another at all times, but were more partial to *A. angulata* than the other varieties."

The cross breeding of sheep, J. S. LOOSLEY (*Rhodesian Agr. Jour., 3 (1906),*

No. 6, pp. 619–624, pls. 3).—A summary of data on the success which has attended the crossing of native Kafir and Africander ewes with imported well-bred rams. Under present conditions, in the author's opinion, farmers can not do better than to breed such crosses.

The swine industry in Ontario (*Ontario Dept. Agr. Bul. 149, pp. 36*).—On the basis of answers received to a circular list of questions, data are summarized regarding the condition of the swine industry in the various counties of the Province of Ontario.

The majority of the counties gave preference to the Yorkshire breeds. Pure-bred sires are used almost entirely. The general tendency throughout the province is slightly to increase the production of pork. The average cost of summer feeding is estimated to be $4.51 per hundredweight and winter feeding $5.38. "A number of correspondents, especially in western Ontario, state that with comfortable quarters and roots the cost of feeding is no greater in winter than in summer."

The bulletin also contains a summary of data on the poultry industry by G. E. Day.

Inheritance of color coat in swine, W. J. Spillman (*Science, n. ser., 24 (1906), No. 614, pp. 441–443*).—A brief statement regarding breeding experiments with Tamworth, Yorkshire, Poland China, and Duroc Jersey pigs and the wild boar of Europe, conducted by Q. I. Simpson.

The results are not regarded as conclusive, "but they do render it highly probable that there are good Mendelian characters in this class of animals."

Origin and history of the horse, H. F. Osborn (*Proc. N. Y. Farmers, 1905–6, pp. 5–20, pls. 19*).—The origin of the horse, distribution and migration of horses, and related questions are discussed very largely on the basis of the author's recent studies and discoveries of fossil remains.

Poultry (*[Quart.] Rpt. W. Va. Bd. Agr., 1906, No. 2, pp. 159, figs. 38*).—Articles by a number of writers on various topics connected with poultry raising are included in this report, as well as a summary of experiment station work on the subject, one of the articles being by K. C. Atkeson on white guinea fowls (pp. 40, 41). It is stated on the basis of personal experience that this variety is more satisfactory than other varieties, since they are tamer and lay in the chicken house instead of seeking out-of-the-way nests, while they are particularly satisfactory for table fowls.

"The young guinea does not require as much care as the turkey, but if hatched early will require more care than chickens. June [in West Virginia] is about the best month to have them hatch, and if they are kept confined for the first few days so that they will not exercise too much, they will get along all right as they are exceptionally free from disease."

Poultry, A. G. Gilbert and V. Fortier (*Canada Cent. Expt. Farm Bul. 54, pp. 75, pls. 5, figs. 55*).—In this bulletin, which summarizes data on the rearing, feeding, and management of poultry, experience gained at the experimental farms has been summarized, as well as general information.

The breeding, feeding, and general management of poultry, A. G. Gilbert (pp. 5–28).—The author calls attention to the principles which underlie profitable poultry raising, describes breeds, and discusses rations and manner of feeding them, the molting of fowls and methods of shortening this period of nonproduction, and related topics. There are also short chapters on turkeys, ducks, and geese.

On incubation, the rearing and fattening of chickens and fowls, poultry buildings, etc., V. Fortier (pp. 29–75).—The author treats of incubation, natural and artificial poultry raising, the growth of chickens and the fattening of

hens, poultry buildings and runs, and the treatment of poultry diseases, injuries, etc.

Poultry for export, G. Bradshaw (*Agr. Gaz. N. S. Wales, 17 (1906), No. 8, pp. 826–858, figs. 11*).—A competition in raising poultry for market showed that under local conditions chickens can be raised to three and a half or four months at a cost of twenty-five cents each. Detailed statements are made regarding the quality of the poultry shipped to the London market and the condition of the poultry industry as a whole. The author believes that the local demand for poultry of good quality can be greatly increased.

Meat powders, etc., for poultry food (*Agr. Gaz. N. S. Wales, 17 (1906), No. 8, p. 859*).—An analysis is reported of a poultry food of animal origin.

Color in birds and color feeding, L. Dechmann (*Rel. Poultry Jour., 13 (1906), Nos. 6, pp. 618, 619, 628; 7, pp. 683, 684, 702, 703, figs. 3; 8, pp. 755–757, 800, 801, figs. 4*).—The general question of color of poultry feathers and factors which affect it are considered and data summarized on the possibility of influencing the color of feathers and shanks by colored light and by feeding pigment.

The castration of ostriches, Elley (*Agr. Jour. Cape Good Hope, 29 (1906), No. 3, pp. 349–354, fig. 1*).—The operation of caponizing ostriches is described. It is claimed that caponizing induces increased weight of feathers, better physical condition of the birds in times of drought or scarcity, and a probable improvement of the flesh, provided the birds should be used as food, while it lessens the dangers from fighting.

DAIRY FARMING—DAIRYING—AGROTECHNY.

On the influence of asparagin on the production of milk and its constituents, T. Pfeiffer, W. Schneider, and A. Hepner (*Mitt. Landw. Inst. Breslau, 3 (1906), No. 5, pp. 747–770*).—In experiments with 3 goats in continuation of earlier work (E. S. R., 17, p. 396), the addition of 45 gm. of asparagin daily to a basal ration was compared with the addition of 58 gm. of aleurone to the same ration. The results as judged by the increase in the yield of milk, total solids, and fat were almost as favorable for the asparagin as for the aleurone. When the asparagin was fed, however, the live weight of the animals decreased, while a slight increase was observed when the aleurone was fed. It is therefore concluded that the asparagin increased the milk production at the expense of body weight, and that this amid in contrast to aleurone and other proteids is not to be classed as a true nutrient, but as a condimental or stimulating substance.

Report of the Spotted Swiss Cattle Breeders' Association, 1905 (*Ann. Agr. Suisse, 7 (1906), No. 5, pp. 285–324, pl. 1*).—The average annual yield of 88 cows of this breed was 3,608 kg. of milk, showing an average fat content of 3.93 per cent and total solids of 13.04 per cent.

Examination of colostrum of goats, M. Siegfeld (*Milchw. Zentbl., 2 (1906), No. 8, pp. 360–363*).—The analysis of a sample of colostrum obtained during the first day of lactation showed the following composition: Total solids, 28.16; total proteids, 8.40; casin, 3.68; fat, 14.70; sugar, 2.94; and ash, 0.99 per cent. On the second and third days the total proteids decreased to 4.14 and 4.46 per cent, respectively, and the fat to 5.10 and 5.50 per cent. The fat obtained during the second and third days showed a Reichert-Meissl number of 28.7, a Polenske number of 5.15, a saponification number of 227.2, and an average molecular weight of the nonvolatile fatty acids of 259.7. The percentages af cholesterin and lecithin were respectively 0.042 and 0.091.

Market milk investigations. II, The milk and cream exhibit at the National Dairy Show, 1906, C. B. LANE (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 87, pp. 21, pls. 4*).—This bulletin gives the results of an experiment in judging or scoring milk and cream in a contest conducted at the National Dairy Show held in Chicago February 15–24, 1906. The work was designed to be educational in character by showing some of the possibilities in the handling and keeping of milk and cream.

The exhibits were divided into 3 classes—certified milk, market milk, and cream. The conditions of entry required that the milk or cream be a fair sample of the product as sold by the exhibitor and that it be free from preservatives and not pasteurized or sterilized. All the milk and cream entered in the contest was produced on February 12, packed in ice, shipped to Chicago, and scored on February 15. The number of exhibitors in the 3 classes mentioned were, respectively, 8, 23, and 17.

For certified milk the numerical scores allowed for perfect were as follows: Flavor, 40; chemical qualities, 20; keeping qualities, 30; and general condition and appearance of package and contents, 10. For market milk the corresponding points allowed were 40, 25, 25, and 10; and for cream 40, 20, 25, and 15. The tests used in judging flavor, chemical qualities, and keeping qualities are mentioned, and the appearance of the packages and contents in the different exhibits is described and illustrated.

The certified milk showed a great difference in flavor, but in no instance was this pronounced disagreeable. The fat content of the samples ranged from 3.8 to 5.3, averaging 4.5 per cent. The percentage of total solids ranged from 12.40 to 13.94 and averaged 13.33. The number of bacteria ranged from 0 to 51,000. The percentage of acidity varied from 0.171 to 0.198 and averaged 0.186. The numerical scores varied from 87 to 98 and averaged 94.8. The highest score was obtained by a Maryland exhibitor, whose dairy is briefly described.

The market milk, in some instances, had an undesirable flavor. The fat content ranged from 2.6 to 7.1 and averaged 4.5. The total solids ranged from 11.42 to 16.38 and averaged 13.49. The acidity ranged from 0.171 to 0.258 and averaged 0.200 per cent. The number of bacteria ranged from 400 to 21,000,000 per cubic centimeter. The total score ranged from 71 to 96 and averaged 89.7. The market milk receiving the gold medal was exhibited by a Wisconsin dairyman under conditions which are briefly described.

The fat content of the cream samples ranged from 17 to 44 per cent, the acidity from 0.171 to 0.270 per cent, the number of bacteria per cubic centimeter from 0 to 2,810,000, and the total scores from 86 to 98. Brief mention is made of the conditions under which the cream receiving the highest reward was produced.

The results are considered most gratifying in showing that milk and cream produced under sanitary conditions can be shipped long distances and be held several weeks without other means of preservation than cleanliness and cold. Some of the certified milk samples were found sweet after 5 weeks. Some of the cream was sweet and palatable after a period of 7 weeks. The certified milk was found quite superior to the market milk. As a large percentage of the samples of market milk remained sweet for 1 week in the exhibit case at a temperature of about 50° F., it is considered as demonstrated that market milk will keep for several days if handled with reasonable care and kept at a temperature below 50°. The medals were won by herds largely of mixed breeding, indicating that the sanitary conditions and methods of handling milk are of more importance than the breed of cows.

A discussion on milk supply (*Brit. Med. Jour., 1906, No. 2386, pp. 669–*

674).—This discussion before the Toronto meeting of the British Medical Association was opened by papers on The Protection and Control of the Milk Supply, by R. Harcourt; The Sanitary Control of the Milk Supply, by J. Glaister; and The Protection and Control of Milk Supplies, by H. C. Pattin.

In these papers and the general discussion which followed various phases of the milk-supply problem were considered and the conditions required of milk in the light of modern research set forth. A resolution was adopted urging the better enforcement of British laws concerning the housing of dairy cattle and the inspection of animals and dairies.

On the sugar in milk, J. SEBELIEN (*Upsala Läkareför. Förhandl., n. ser., 11 (1906), Sup., pp. 10*).—A considerable difference was observed between the amount of sugar in milk as determined by polarimetric and gravimetric methods. This difference is attributed to the presence of a pentose corresponding in amount to 0.07 per cent of arabinose.

On the composition of tuberculous milk, A. MONVOISIN (*Rev. Gén. Lait., 5 (1906), Nos. 20, pp. 457–463; 21, pp. 492–498*).—Nine examinations during 1 month were made of the milk of a cow affected with mammary tuberculosis. The results showed a diminution in acidity, an increase in total nitrogen, a decided and progressive decrease in the amounts of fat and lactose, a marked increase in sodium chlorid, and a lowering of the index of refraction. Contrary to results reported by other observers, the freezing point was found to remain very constant.

On the so-called reductase in milk, H. SMIDT (*Arch. Hyg., 58 (1906), No. 4, pp. 313–326*).—The author discusses the reduction of methylene blue by milk as affected by the growth of bacteria. He concludes that the reduction of a solution of methylene blue and formaldehyde by fresh milk is not due to bacteria, but to an enzym secreted with the milk which decomposes the aldehyde, and which he, therefore, designates aldehyde catalase. This ferment is not considered a reductase, as the reducing action on methylene blue is due to the formaldehyde. The presence of a true reductase in milk, according to the author, has not yet been proved. A distinction is made between aldehyde catalase and superoxydase, both of which are present in milk.

The author finds that the reducing power of milk runs parallel with the development of bacteria, and, as suggested by Neisser and Wechsberg, believes that this fact may be utilized in milk hygiene. In raw milk methylene blue in the absence of an aldehyde is reduced, according to the author, only by the action of bacteria. Without working out a practical method he concludes as the result of his own experiments that milk of which 0.1 cc. is reduced by 4 cc. of a 0.003 per cent solution of methylene blue at 37° C. within 2 hours is objectionable on the ground of an excessive bacterial content.

A method of obtaining milk free from living tubercle bacilli and other organisms and not materially changed in its properties, H. MUCH and P. H. RÖMER (*Beitr. Klinik Tuberkulose, 5 (1906), No. 3, pp. 349–364*).—The milk is drawn with great care into a pail containing 3.3 cc. of a 30 per cent solution of hydrogen peroxid, or 33 cc. of a 3 per cent solution for each liter of milk to be obtained. The milk is allowed to stand for 12 to 14 hours, when it is heated to 52° C. for 1 hour. Five to 8 hours later a preparation, designated normal catalase, is added to the milk in the proportion of 4 drops per liter, which decomposes all the hydrogen peroxid and completes the process. The authors designate the product perhydrase milk. The method is said to produce no modification in the color, taste, or other properties of the milk, and to render it sterile.

Influence of light on perhydrase milk, H. MUCH and P. H. RÖMER (*Berlin.*

Klin. Wchnschr., *43* (*1906*), *Nos. 30, pp. 1004–1007; 31, pp. 1041–1046*).—The authors observed changes in the color, odor, and taste of milk previously sterilized with hydrogen peroxid and exposed to the light. Similar changes were observed in milk powder. The investigations indicated that these changes were produced by the combined action of oxygen and light and that they affected mainly the fat.

Different colored bottles were filled with the milk and exposed to the sunlight. The results showed that the red and green rays were without influence, while the ultra-violet, blue, and yellow rays produced marked changes. The same differences were observed when uncolored bottles filled with milk were wrapped with different colored silk paper. In order to prevent changes in the milk it is therefore necessary to exclude the light or wrap the bottles in red or green paper.

Experiments were made with mice to determine if the modified milk has injurious properties. While the results did not warrant positive conclusions, the authors believe that the use of such milk may not be without bad effects on infants.

The use of sodium citrate as a modifier of cows' milk, J. W. England (*Jour. Amer. Med. Assoc.*, *47* (*1906*), *No. 16, pp. 1241–1243, figs. 16*).—The author concludes from the experimental data reported in this article that when citrated milk is brought into contact with the gastric juice, the sodium citrate is decomposed by the hydrochloric acid into sodium chlorid and citric acid and that the resulting sodium chlorid exerts important physical, chemical, and physiological influences in the digestion of the milk proteids. The citric acid liberated is not believed to have any greater therapeutic value than the hydrochloric acid. In the cold, sodium citrate has no decomposing action on calcium casein.

Condensed milk, P. Diffloth (*Indus. Lait* [*Paris*], *31* (*1906*), *No. 32, pp. 523–525*).—Notes are given on the manufacture of condensed milk without the addition of cane sugar. Samples so prepared contained a much higher percentage of water than usual. The composition of condensed milk made from whole milk without the addition of cane sugar was as follows: Water 61.46, proteids 11.17, fat 11.42, lactose 13.96, and ash 1.99 per cent; and that from skim milk as follows: Water 68.62, proteids 12.34, fat 0.26, lactose 15.73, and ash 2.96 per cent.

Variations in the test of separator cream (*Kansas Sta. Bul. 137, pp. 203–211*).—The experiments reported in this bulletin show the extent of variations in the fat content of cream due to several causes. The principal results are stated as follows:

"1. The temperature of milk makes a difference of from one to five per cent in the test of cream at average skimming temperature, greater variation being caused in extreme cases.

"2. The amount of flush water used with average skimming temperatures makes a difference of from one to three per cent, in extreme cases making a difference as great as ten per cent.

"3. The variation in steadiness of the bowl makes a difference of from two to sixteen per cent, depending on the amount of vibration.

"4. The variation of the speed of the bowl causes a difference of from one to thirteen per cent in the test of cream, depending on the variation in speed.

"5. The amount of milk allowed to flow through the separator bowl from one-half to full capacity makes a difference of from one to six per cent, depending upon the divergence from full capacity of the machine.

"6. The amount of acid in the milk causes an irregular variation in the test of cream, depending upon the amount of acid it contains. Where the acid

reaches a high point, 0.3 to 0.4 per cent for instance, and the separator is used continuously for an hour or more, it will eventually clog the same as in the case of cold milk. The cream will then become thicker until the separator is entirely clogged. The extent of the clogging will depend on the amount of acid in the milk and the size of the machine. The higher the acidity and the smaller the machine the sooner the separator will clog."

Improving the quality of cream from inferior milk, W. D. SAUNDERS (*Virginia Sta. Bul. 162, pp. 145–156, figs. 2*).—In the method described in this bulletin sour or bad-flavored milk is closely skimmed and the cream so obtained is diluted to any desired extent with fresh skim milk.

In one of the experiments reported a composite sample taken from 12 lots of milk and cream showed an acidity of 0.24 per cent. The cream, as taken from the separator, showed an acid content of 0.117 per cent. The skim milk used for diluting the cream contained 0.15 per cent acid. The acidity of the mixture before pasteurizing was 0.13 per cent and after pasteurizing 0.121 per cent. A can of this cream which contained 40 per cent of fat was cooled to a low temperature, covered with a felt jacket about 1 in. thick, and shipped to New Orleans, the time in transit being about 36 hours. So far as known this cream reached its destination in prime condition and gave good satisfaction.

Two other experiments of a like nature are reported.

Effect of bacteria in wash water of butter (*Kansas Sta. Bul. 138, pp. 212–222, figs. 2*).—Experiments were conducted at the station at three different times of the year to determine the amount of contamination in various kinds of water used for creamery purposes. Determinations of the number of bacteria in well water, pasteurized, sterilized, filtered, and treated in other ways and in melted ice are reported, and scores are given of the butter washed with the different kinds of water. The conclusions drawn from the work are as follows:

"1. It is both practical and economical to sterilize wash water for butter if it can be cooled and used immediately. Otherwise, the practice is a useless expense.

"2. A filter for creamery water is only a source of contamination and filth unless frequently cleaned and refilled with fresh filtering material.

"3. Water melted from ice, even though kept at 50° F., may become filled with bacterial growth if allowed to stand for a few hours in a wooden tank from day to day without thorough cleaning. Great care should therefore be taken in the utilization of such water for cooling purposes.

"4. There is a direct relation between the bacterial content of the wash water used and the keeping quality of the butter.

"5. Water kept at a low temperature from 40° to 50° F. for a few hours inhibits the development of bacteria, or destroys from one-half to four-fifths of those present."

Investigations in the manufacture and storage of butter. II, Preventing molds in butter tubs, L. A. ROGERS (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 89, pp. 13, fig. 1*).—Notes are given on molds and experiments on preventing their growth in butter tubs are reported.

In each of 6 trials, 1 tub was soaked in cold water over night in the usual way, 1 was boiled 5 minutes in a saturated brine and left in the brine all night, 1 was soaked over night in a brine containing 9 per cent of commercial formalin, 1 was coated on the inside with paraffin, and 1 was immersed for a few seconds in a bath of paraffin at 250° to 260° F. All the tubs in each lot were filled from the same churnin ; and otherwise treated alike.

Of the untreated tubs all became moldy. Of those treated with hot brine, 1

was badly molded, 1 slightly molded, and 1 molded on the outside. Of those treated with formaldehyde, 1 was badly molded, and of those coated with paraffin none showed any mold whatever. The author considers that dipping the tubs has no particular advantage over coating the inside. Directions are given for applying the paraffin and notes are given on the cost. The advantages of paraffining are summarized as follows: (1) Certain prevention of moldy tubs, (2) prevention of mold on butter and liner by avoiding air space, (3) neater appearance of tub, and (4) reduction of loss from shrinkage.

On butter powders, F. Reiss (*Milchw. Zentbl.*, *2* (*1906*), *No. 8*, *pp. 368–370*).—An unfavorable report is made upon the use of preparations designed to be added to cream for the purpose of increasing the yield or quality of butter. Tests were made of two such preparations.

Butter trade (*London:* [*Bd. Agr. and Fisheries*], *1906*, *pp. XL + 459*).—This is a report of the committee of the Board of Agriculture and Fisheries of Great Britain appointed to consider the need of further legislation concerning the trade in butter and butter substitutes.

The report contains the evidence of 49 witnesses, legislation in other countries, and the conclusions of the committee which include among other recommendations that butter factories should be registered, that no substances be added to butter whereby the percentage of moisture is increased, that the addition to butter of any fat not derived from milk be expressly and directly prohibited, that neither butter nor margarin shall contain more than 16 per cent of water, that penalties for the importation of adulterated butter be proportional to the magnitude of the consignment, and that substances other than butter and margarin containing butter fat be sold with a limit of 24 per cent of moisture under a name approved by the Board of Agriculture and Fisheries.

On the influence of salting on the formation of holes in Emmenthal cheese, O. Jensen (*Landw. Jahrb. Schweiz*, *20* (*1906*), *No. 8*, *pp. 437*, *438*).—Different quantities of sodium chlorid ranging from 0.5 to 10 per cent were added to a peptone bouillon containing calcium lactate and the medium inoculated with propionic-acid organisms. It was found that the presence even of 0.5 per cent of salt checked the development of the organisms and that 10 per cent prevented their growth entirely. This injurious influence upon the growth of bacteria is attributed to the formation of calcium chlorid which causes a precipitation of the proteids.

In earlier investigations the author found that the outer portions of Emmenthal cheese contained more salt than the interior of the cheese. This is therefore offered as an explanation why the outer layers of large Emmenthal cheeses and also small cheeses contain fewer holes than the central part of large cheeses.

On the lactic fermentation in Emmenthal cheese, O. Jensen (*Ann. Agr. Suisse*, *7* (*1906*), *No. 4*, *pp. 253–281*; *Milchw. Zentbl.*, *2* (*1906*), *No. 9*, *pp. 393–414*; *Rev. Gén. Lait*, *5* (*1906*), *Nos. 20*, *pp. 464–470*; *21*, *pp. 481–492*; *22*, *pp. 508–579*).—Lactic ferments, according to the author, exercise an indirect influence in cheese ripening in restraining gassy fermentation and putrefaction, and a direct influence in the decalcification of the paracasein and the decomposition of the albuminoid substances.

In the investigations reported the author did not find as high a degree of acidity in Emmenthal cheese 4 hours old as was found by Peter (E. S. R., 16, p. 1019). The acidity of the whey in the interior of the cheese at this stage decreased from 28 to 11° (cubic centimeters of tenth normal sodium hydroxid solution required to neutralize 100 cc. of whey) as the temperature of cooking increased from 48 to 60° C. Lactic fermentation was apparently greatly reduced by heating the curd above 58°.

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When the evening milk was kept cool over night the acidity of the whey in the cheese varied from 6 to 13°, and when the milk was kept warm from 16 to 26°. The highest degree of acidity found in cheese 4 hours old in these experiments was 29°. The ripening of the evening milk was, therefore, considered of great importance in the acidification of the whey in the cheese during the first 6 hours after manufacture.

The addition of 1 per cent of culture to the evening milk did not seem to increase the acidity. It is believed that acidification takes place mainly within the interior of the cheese, and in the early stages of this process the most important organism concerned is a hitherto unrecognized streptococcus, which is to be the subject of a special report. Later *Bacillus casei* ε predominates This organism, considered the most important in the ripening of this cheese, reaches its maximum development soon after the cheese is made, which fact is believed to confirm the view previously put forth by the author that the ripening of hard cheese is due to the enzyms liberated by the disintegration of bacterial bodies which were formed in the cheese during the first few days.

In regard to the process of decalcification, the author concludes that in fresh Emmenthal curd inorganic calcium and inorganic phosphoric acid exist in the same proportions as in tricalcic phosphate, and that during the acidification of the cheese the greater part of the tricalcic phosphate is transformed into dicalcic phosphate, and hence does not pass into the whey.

In order to lessen the danger of gassy fermentation in Emmenthal cheese, it is recommended that the evening milk be held at a temperature of about 20°, or where much trouble of this kind is experienced that the evening milk be cooled and cultures of *Bacillus casei* ε and the streptococcus referred to be added to the milk before making into cheese.

Investigations of O. Johan-Olsen on the manufacture and ripening of cheese, Huss (*Milchw. Zentbl., 2 (1906), No. 8, pp. 363–368*).—This is a review of the investigations of O. Johan-Olsen on the use of pure cultures of yeasts in the manufacture of various kinds of cheese.

A rennet-producing bacterium isolated from Galium mollugo, J. Hohl (*Landw. Jahrb. Schweiz, 20 (1906), No. 8, pp. 439–444*).—The organism isolated from this plant is described as a variety of *Bacterium synxanthum*. It was found to be capable of coagulating milk without the formation of acid. The author also notes the isolation from soil of a bacillus having the same properties as regards the coagulation of milk.

Review of the work of the season for 1905–6, J. A. Kinsella (*New Zeal. Dept. Agr., Dairy. Div. Bul. 8, pp. 91, pls. 14*).—This report contains statistics on the exports of dairy products from New Zealand and discussions on a number of subjects of practical interest in dairying, such as salting butter, mottled butter, moisture in butter, paraffining butter boxes, use of preservatives, testing dairy herds, pasteurization, milking machines, etc. The exports during the year amounted to 314,165.5 cwt. of butter, valued at £1,696,493, and 121,322 cwt. of cheese, valued at £376,098. Some experiments in keeping butter at freezing temperatures from March 4 to May 8 are reported. None of the butter of first quality showed any appreciable deterioration during that time. The coating of butter boxes with paraffin is urged on the grounds of saving a considerable amount of shrinkage. Yearly records of 3 private dairy herds are included.

Nineteenth annual report of the Bern dairy school at Rütti-Zollikofen for the year 1905–6 (*Jahresber. Molk. Schule Rütti-Zollikofen, 19 (1905–6), pp. 56, pls. 2, figs. 2*).—In addition to an account of the educational work of this school, the report contains brief summaries of experimental work concerning the testing of milk, gassy fermentation in cheese, use of pure cultures

in the preparation of rennet, determination of the acidity in whey from cheese, and variations in the chemical composition of milk.

Report of the dairy institute at Proskau, 1905–6 (*Ber. Milchw. Inst. Proskau, 1905–6, pp. 29*).—A report of the work of this institute during the year, including analyses of a large number of samples of milk.

Officials, associations, and educational institutions connected with the dairy interests of the United States for the year 1906 (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 99, pp. 14*).

Production of lactic and acetic acids from milk sugar, KAYSER (*Indus. Lait.* [*Paris*], *31* (*1906*), *No. 36, pp. 586–589*).—The principles involved in the manufacture of lactic acid and acetic acid from milk sugar are briefly stated and figures given to show the profits in this industry.

Hawaiian waste molasses, S. S. PECK (*Hawaiian Sugar Planters' Sta., Dir. Agr. and Chem. Bul. 18, pp. 28*).—It is stated that in the mills of Hawaii the waste molasses to each ton of sugar manufactured amounts to from 15 to 23 gal., averaging 55 per cent of sucrose. With a view to determining if the exhaustion of molasses depends upon the ratio existing between the invert sugar and inorganic salts as found by H. C. P. Geerligs in factories in Java, analyses were made of the products of a number of factories during 2 seasons. The methods of analysis employed and the results obtained are given in full. The author's summary is as follows:

"(1) The ratio of glucose to ash does not serve as an indication of the exhaustion of the Hawaiian molasses.

"(2) The limit of the further recovery of sugar is established principally by the viscosity of the molasses.

"(3) The viscosity of the molasses originates with the gums, and any method reducing the quantity of gums or their stickiness, makes for the possibility of further recovery of sugar.

"(4) The ashes of molasses and the composition of the ashes vary with the conditions of growth of the cane and the amounts of lime used in the clarification of the juices.

"(5) A high salt content in the irrigation water increases the potash and chlorin in the ash, but not to an appreciable extent the soda with which chlorin was originally combined."

The influence of selected yeasts upon fermentation, W. A. P. MONCURE, R. J. DAVIDSON, and W. B. ELLETT (*Virginia Sta. Bul. 160, pp. 97–120, figs. 2, charts 4*).—Brief notes are given on the changes which take place during the transformation of the fruit juice into an alcoholic beverage, the sources of yeasts in nature, and on the natural control of fermentation, and experiments showing the individuality of yeasts are reported.

Tests were made to determine the effect upon unfermented cider of two yeasts designated No. 37 and No. 66. Under identical conditions the yeast No. 37 liberated 18.9 gm. of CO_2, and yeast No. 66, 19.68 gm. The cider fermented with yeast No. 37 contained 4.56 per cent of alcohol and 0.472 per cent of acid. The cider fermented with yeast No. 66 contained 4.84 per cent of alcohol and 0.514 per cent of acid. The aroma produced by yeast No. 37 was pronounced very rich, fruity, and extremely pleasant, while that produced by yeast No. 66 was rather sharp and of an acid and slightly disagreeable nature. These 2 yeasts were further compared in some 34 tests. The results with both yeasts were compared with natural fermentation as regards the amount of carbon dioxid liberated and the composition of the fermented ciders. The percentage of alcohol produced by natural fermentation was 4.44; by yeast No. 37, 4.70; and by yeast No. 66, 4.83. The amount of yeast found necessary to dominate fermentation was 1 to 400 parts of must.

The station has a collection of about 70 pure cultures of yeasts, the more promising of which are briefly noted.

The influence of sulphurous acid on fruit wines, II. Müller-Thurgau (*Centbl. Bakt.* [*etc.*], *2. Abt.*, *17* (*1906*), *No. 1–2*, *pp. 11–19*).—In laboratory experiments during several years fresh pear juice was treated with sulphur dioxid in different amounts. In this way the development of injurious organisms such as lactic-acid bacteria was checked or prevented. The favorable influence of this treatment was the more marked the sooner it was applied after pressing. As compared with samples not treated with sulphur this method increased in general the alcoholic content of the fermented product and also the nonvolatile acids, but decreased the amount of volatile acids. The lactic acid in treated samples was only one-third that in untreated samples. The free sulphur dioxid disappeared rapidly so that only small quantities were present in the perry. The total amount of sulphur dioxid, however, showed no decrease. It is suggested that potassium metasulphid may be used instead of the sulphur dioxid.

The method was applied to perry making under practical conditions with equally satisfactory results. The use of 84 mg. of sulphur dioxid per liter was as favorable as a larger amount. The perry contained a total of 83 mg. of sulphur dioxid per liter with 4 mg. in a free form. The combined form is believed to be free from objections from the standpoint of health.

Filtration of wine, L. Moreau (*Rev. Vit.*, *26* (*1906*), *No. 663*, *pp. 229–234*).—Analyses are reported of a number of samples of wine before and after filtration. The results showed a considerable modification in the composition of the wine. The method nevertheless is considered at times indispensable in clarification.

The manufacture of Jamaica rum, C. Allan (*West Indian Bul.*, *7* (*1906*), *No. 2*, *pp. 141–152*).—This report contains a description of the process of manufacturing rum in Jamaica, with analyses of a large number of samples of rum and of fermentation products of distilleries.

A complete course in canning (*Baltimore: The Trade, 1906, pp. 176, fig. 1, map 1*).—This book gives directions for the building of canning factories, discusses the economics of the business, and gives detailed formulas for the canning and preserving of all the vegetables, fruits, fish, meats, and soups commonly canned. Data for making jams, jellies, mince-meats, pie filler, spice mixtures, etc., are also given.

Flax spinning in France, C. J. King (*Daily Consular and Trade Rpts.* [*U. S.*], *1906*, *No. 2663*, *pp. 4, 5*).—This report on the spinning of flax and flax waste contains a description of a new method for the spinning of these articles which it is believed should be of considerable value in developing the linen industry in the United States. The new process, which is invented by A. Guillemaud and protected by patent, consists in an adaptation to flax of the system now employed in spinning cotton.

Industrial by-products utilized in agriculture as foods and as fertilizers, E. Collin and É. Perrot (*Les résidus industriels utilisés par l'agriculture comme aliments et comme engrais. Paris: J. B. Baillière & Son, pp. XI + 299, figs. 93; rev. in Mois Sci.*, *8* (*1906*), *No. 3*, *p. 15*).—The work deals with the by-products of the manufacture of oils, perfumes, extracts, etc., used in agriculture as foods or fertilizers. The first part gives general information regarding the source, composition, and use of oil cake and like products, but the second consists of original monographs on the morphology of oily seeds and fruits, and on the external appearance, microscopic character, chemical composition, sophistication and adulteration, uses, therapeutic value, poisonous

properties, and advantages and disadvantages of cakes used as foods and as fertilizers.

VETERINARY MEDICINE.

The veterinary service of the United States, R. Ostertag (*Das Veterinärwesen der Vereinigten Staaten von Nord-Amerika. Berlin: Richard Schoetz, 1906, pp. VIII + 151, figs. 17*).—The author spent 2 months in the United States for the purpose of studying our institutions designed for instruction in animal industry and veterinary science, the stock yards, abattoirs, cold storage plants, meat inspection, dairy farms, milk inspection, city milk supply, methods of combating various animal diseases, and other veterinary matters. The opinion of the author regarding the status of animal industry and veterinary science in this country is of considerable interest on account of his standing in Germany and his wide experience with these matters.

With regard to veterinary schools, the author speaks in high praise of 2 or 3 of them, but criticises the standard of instruction in some of the private schools without endowment in which the only source of income is from student fees. The systems of instruction in animal industry and dairying are considered as being of a very practical and efficient nature. Special mention is made of the Iowa Agricultural College in the line of animal industry and of the Wisconsin Agricultural College in dairying.

In summarizing his impressions of animal industry and veterinary science in the United States, the author states that veterinary education with us is still in its infancy, but shows many strong features, particularly the practical instruction in animal breeding and stock judging offered to students in veterinary science. The work of the Bureau of Animal Industry is praised for its efficiency, particular mention being made of the control work on Texas fever, sheep scab, tuberculosis, and hog diseases. The conditions which prevail on the better class of dairy farms and the regulations already in force in many cities for the inspection of milk conspire, in the author's opinion, toward furnishing an excellent city milk supply at a reasonable price.

The veterinary section, A. Theiler et al. (*Transvaal Agr. Jour., 4 (1906), No. 16, pp. 777–804*).—Although foot-and-mouth disease prevailed greatly in South Africa in 1893 no outbreak has occurred since 1903. The colonial laws regarding this disease are apparently satisfactory. Notes are given on the present status of Texas fever, African coast fever, anthrax, and glanders.

In the case of glanders, attention is called to the danger from horses affected with a mild form of the disease. It is believed that if an indemnity were paid for such cases by the government the owner's consent to the destruction of the animal could readily be obtained, and the spread of the disease would thereby be checked. Notes are also given on sheep scab and horse sickness.

Results of investigations in the field of general pathology and pathological anatomy, O. Lubarsch and R. Ostertag (*Ergeb. Allg. Path. Mensch. u. Tiere, 10 (1904–5), pp. XV+989, pl. 1*).—As usual in this series of reports, a detailed review is given of literature bearing on the pathology of man and animals, together with classified bibliographical references. A review of Russian literature on general pathology for the years 1904–5 is presented by R. Weinberg. Particular attention was given to trypanosomiasis, tuberculosis, and tumors. The review of literature on tuberculosis was prepared by A. Eber.

The army horse in accident and disease, A. Plummer (*[U. S. War Dept.], 1906 [rev. ed.], pp. 116, pls. 22*).—The school of application for cavalry and field artillery at Fort Riley, Kansas, offers opportunity for the practical training of students in the management of the common diseases of horses and mules and

in the care of horses in health. The present volume is prepared as a manual for the use of students in the training school for farriers and horseshoers. It contains a brief account of the symptoms and treatment of the common diseases of horses arranged according to the part of the body affected or the nature of the disease. The conformation and points of the horse are also described and notes are given on stable management, anatomy, and the use of medicines.

Modern phthisiogenetic and phthisiotherapeutic problems from an historical standpoint, E. von Behring (*Beitr. Expt. Ther., 1906, No. 11, pp. XXXVI+156*).—Since 1901 the author and his disciples have issued numerous publications dealing with the progress of their work on various problems of tuberculosis. The present account is in the nature of an historical summary of this work with explanations of its bearing upon the practical control of tuberculosis and with the consideration of certain points of priority which have arisen. The use of the author's bovovaccin has been tested on such a large scale that it is now believed to rest upon the firm basis of practical experience. Many of the controversial matters relating to phases of the tuberculosis problem are discussed, particularly the question regarding the chief source of contagion in tuberculosis. The author adheres to his position that tuberculosis in both man and animals is very largely transmitted through the alimentary tract rather than through the lungs. Infection, in the author's opinion, takes place chiefly during an early age.

In the near future it is stated that the author's new method for the control of tuberculosis by the use of tuberculase will be explained in greater detail and will be offered for experimental use. This material is obtained by first extracting from the tubercle bacilli those substances which are soluble in water, alcohol, and salt solution, after which the remainder of the bacterial bodies is thoroughly pulverized and prepared for use in a liquid form. At first the method appeared not to promise much from a practical standpoint for the reason that the elaborate method necessary for obtaining tuberculase made the material altogether too expensive. Much improvement has been made in cheapening the method of manufacture, and the author therefore hopes to be able to prepare the material at a reasonable cost. Tuberculase is not infectious and does not contain living tubercle bacilli. It is, therefore, recommended by the author in the treatment of human tuberculosis. The use of a vaccine such as is used in preventing bovine tuberculosis is not recommended in the case of man.

The intestinal origin of pulmonary tuberculosis, A. Calmette and C. Guérin (*Ann. Inst. Pasteur, 20 (1906), No. 5, pp. 353–363*).—In a previous investigation by the authors it was found that, contrary to von Behring's contention, adult animals, at least in the case of goats, became infected with tuberculosis through the alimentary tract more readily than young animals. In the present article an account is given of further work along this line on cattle. In these experiments virulent bovine tubercle bacilli were used and were introduced into the second and third stomachs by means of a sound passed down the esophagus. The authors believe that the chief reason why experiments in the alimentary infection of cattle have so frequently failed is that tubercle bacilli given in the form of a drench reach the rumen and there become so greatly diluted in a large mass of material in this organ that infection rarely takes place.

In experiments reported by the authors, 4 cows previously determined to be free from tuberculosis were inoculated by the method just described. All of these animals became tuberculous, and the authors conclude that animals may readily contract tuberculosis through the alimentary tract both in young life and at an adult age and without the development of any lesions of the walls of the alimentary tract. According to the authors' observations, tubercle bacilli

are retained in the mesenteric ganglia in young animals and remain in these ganglia sometimes for years, the lesions ultimately healing. In adult animals, on the other hand, the defensive action of the ganglia is less active and the tubercle bacilli are carried more readily into the general circulation, thus reaching the lungs. So-called primary pulmonary tuberculosis of the adult is, therefore, most often of intestinal origin.

Intestinal origin of pulmonary tuberculosis, III, A. CALMETTE and C. GUÉRIN (*Ann. Inst. Pasteur, 20 (1906), No. 8, pp. 609-624*).—An elaborate review is presented of the literature relating to this subject, particular attention being given to an examination of the evidence presented in favor of assuming inhalation as one of the chief sources of tuberculosis. The authors believe, as a result of their studies and direct experiments, that in the immense majority of cases the pulmonary or pleural localization of tuberculous lesions is due to tubercle bacilli carried to the point in question in leucocytes and introduced primarily into the alimentary tract. It is believed, therefore, that animals and man could be practically protected against tuberculosis if the food and water in all instances could be so sterilized as not to contain any tubercle bacilli. In the authors' experience a single intestinal infection with tubercle bacilli produces a mild form of the disease, during which the animal reacts to tuberculin for a period of 1 to 2 months, but frequently recovers, to all appearances, after such a period. In these cases the authors have established beyond question that the animals had recovered and that the animals were insusceptible to the disease. On the other hand, in all cases where a repeated intestinal infection took place, especially if the different infections followed one another at short intervals, the tuberculous lesions developed rapidly and never healed. In the authors' opinion these facts explained the frequently observed presence of healed tubercles in man and animals.

The experimental production of transmissible varieties of tubercle bacilli, S. ARLOING (*Compt. Rend. Acad. Sci. [Paris], 142 (1906), No. 25, pp. 1395-1397*).—The possibility of modifying the virulence of the tubercle bacillus has long been known, but some difficulty has been experienced in securing a race of the bacilli which would show a low virulence and retain it when transferred from one culture to another. The author states that he has succeeded by means of the use of heat in obtaining a culture of tubercle bacilli of such low virulence that the bacilli produce no true infection, but are absorbed and exercise merely a vaccinating effect. The author has also succeeded in making frequent transfers of these bacilli from one culture to another without altering their virulence. The race of bacilli with which the author has experimented has, therefore, become for practical purposes a vaccine without the power of producing infection.

Fat-free tubercle bacilli, H. VALLÉE (*Compt. Rend. Soc. Biol. [Paris], 60 (1906), No. 22, pp. 1020-1022*).—According to the author's experiments tubercle bacilli retained all of their toxic products after being deprived of their fat content. This point was tested by inoculation of calves, horses, and other animals.

Tuberculosis as a cause of condemnation of food animals, REUTER (*Vrtlschr. Bayer. Landw. Rath., 11 (1906), No 2, Sup., pp. 542-557*).—Condemnation of food animals on account of tuberculosis, according to German law, requires the determination of the facts that the animal was intended for food and is affected with tuberculosis to such an extent that more than half of the animal is totally unfit for food or can only be used for food after being treated. The author discusses the legal and sanitary difficulties which have arisen in this connection and considers that a new definition is required of the stage of tuberculosis which necessitates condemnation of the animal.

Retrogressive infection in the development of tuberculosis, A. Kreinberg (*Ztschr. Fleisch u. Milchhyg., 16 (1906), No. 10, pp. 322, 323*).—On account of the great importance of tuberculosis in meat inspection, the author made a study of the course which infection takes in different animals during the progress of the disease. It is found that in some cases infection spreads not altogether in the direction of the currents of blood and lymph. Occasionally the lymph stream appears to become checked and to be turned in a backward direction so that infection sometimes appears in parts of the body where it would not naturally be expected.

Immobility caused by cerebral tuberculosis in cattle, C. Besnoit (*Rev. Vét. [Toulouse], 31 (1906), No. 9, pp. 577–585, fig. 1*).—Brief mention is made of the peculiar symptoms, including inability to move, which appear in cases of cerebral tuberculosis in horses and cattle. In cattle this form of tuberculosis is considered by the author as being quite frequent and details are given concerning the post-mortem lesions found in one case.

Tuberculosis in the bee moth, S. Metalnikoff (*Centbl. Bakt. [etc.], 1. Abt., Orig., 41 (1906), Nos. 1, pp. 54–60; 2, pp. 188–195, pls. 2*).—On account of the fact that the bee moth lives largely on wax in bee colonies, it is obvious that it possesses a ferment capable of dissolving or digesting this wax. The author was, therefore, led to study the action of this ferment upon the wax capsules of tubercle bacilli. It was found that the bee moth is quite immune to tubercle bacilli obtained from man, cattle, or birds. This immunity is due to the very rapid destruction of the tubercle bacilli by means of phagocytes and inside of special capsules formed in the blood or lymph. Even after injection with relatively enormous doses of tubercle bacilli the organism of the bee moth seems to suffer no harm and all of the bacilli are found inside of phagocytes or other cells within 1 hour. The bee moth, however, appears not to be able to destroy tubercle bacilli obtained from fish. After inoculation with these organisms a pronounced phagocytosis takes place, but the phagocytes do not overcome the bacilli and the moth finally dies.

Immunity toward tuberculosis, S. Metalnikoff (*Centbl. Bakt. [etc.], 1. Abt., Orig., 41 (1906), No. 3, pp. 391–396*).—Blood and extracts of various kinds from bee moths were used in treating guinea pigs to determine the effect of such treatment upon the course of infection with tuberculosis. It was found that the blood and body extracts of bee moths were capable of greatly prolonging the life of guinea pigs infected with tubercle bacilli. It was also found that the blood of the bee moth had the power of destroying tubercle bacilli in vitro.

Combating tuberculosis by means of special offices of information, J. Högild (*Maanedskr. Dyrlæger, 18 (1906), No. 2–3, pp. 114–128*).—The mere use of tuberculin for determining the presence of tuberculosis in a herd of cattle is not a satisfactory means of controlling the disease unless further regulations are adopted in order to make the information gained by the use of tuberculin more immediately effective.

The author recommends that special offices be created for reporting cases of tuberculosis in cattle and giving information concerning the procedure with this disease. It is also recommended that the importation of animals into reacting herds of cattle shall not take place until after a sufficient time has elapsed to make sure that the nonreacting cattle are healthy. A plan is proposed for the use of tags for marking healthy and tuberculous cattle so that no mistake can be made. It is also urged that the repeated use of tuberculin in attempts to immunize cattle be prohibited.

The tuberculin test of hogs and some methods of their infection with

tuberculosis, E. C. Schroeder and J. R. Mohler (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 88, pp. 51*).—On account of the prevalence of tuberculosis among hogs in certain localities it is often desirable to use the tuberculin test in separating affected from healthy animals. In the studies which were made by the authors, 12 hogs were infected with tuberculosis by feeding them milk to which tubercle bacilli had been added. Four hogs were allowed to follow cattle affected with tuberculosis, 4 more followed cattle which received tubercle bacilli in their drinking water daily, and 12 hogs were infected with tuberculosis by subcutaneous inoculation.

A study was made of the normal temperature of hogs, and it appears that the temperature of fat hogs is higher than that of poor ones. It was found that the temperature of hogs rises rapidly and to the extent of 3° or 4° as a result of driving or excitement. It became necessary, therefore, to place each hog in a rectangular crate about 12 hours before taking the temperature and to keep them thus confined until the tuberculin test was completed. The temperatures were taken hourly for 16 to 23 hours before injection and for from 30 to 40 hours after injection. The dose of tuberculin was ½ cc. per 100 lbs. of live weight. Of 58 hogs tested with tuberculin, 26 reacted and were found to be tuberculous upon post-mortem examination. In nearly every instance the temperature of tuberculous hogs reached 105° F. after injection.

The reaction to tuberculin begins within 7 hours, reaches a maximum about 14 hours after injection, and continues for 16 hours later. Since it was found that the temperature of hogs might be elevated as much as 4.4° F. by walking 4 minutes at a slow pace, it is obvious that time and labor will be wasted in making a tuberculin test with hogs unless precautions are taken to prevent excitement and worry in the animals. When these precautions are observed, the tuberculin test is practically as reliable with hogs as with cattle.

The temperature and autopsy records are presented in detail in a tabular form. With regard to the method of infection of hogs it was found that the feces of tuberculous cattle or cattle which received tubercle bacilli in their food are highly infectious for hogs which follow them in the feed lot. Hogs readily contract tuberculosis in this way; in fact their susceptibility through exposure to infected food is much greater than that of guinea pigs.

Tuberculin in guinea pigs artificially infected with tuberculosis, P. Stazzi (*Clin. Vet. [Milan], 29 (1906), No. 32, pp. 773–782, pl. 1*).—During the author's investigations it appeared that guinea pigs rendered tuberculous by artificial inoculation show a reaction to tuberculin which becomes more pronounced as the disease progresses. In guinea pigs which show an unusual susceptibility to tuberculin this reagent may cause parenchymous congestion and hemorrhage. In the author's opinion the striking sensitiveness of guinea pigs to tuberculin in advanced stages of tuberculosis is susceptible to several interpretations, but the simplest one is that with the progress of the disease the amount of tuberculin already in the animal body becomes greater until a point is reached where any additional amount can not be endured.

The resistance of tuberculin toward light, H. Jansen (*Centbl. Bakt. [etc.], 1. Abt., Orig., 41 (1906), No. 7, pp. 775–779, fig. 1*).—A test was made of the effect of intensive illumination upon tubercle bacilli killed by light and upon tuberculin.

It was found that the illumination had no influence whatever upon dead tubercle bacilli. The specific toxin of the tubercle bacillus as found in tuberculin is very resistant to light and intense illumination for 2 hours appeared to have no effect upon it.

The simultaneous method of vaccination against anthrax, G. SOBERNHEIM (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 1 (1906), No. 6, pp. 442–450*).—The use of serum and virus simultaneously, according to the method devised by the author, has been extensively tested on all kinds of domestic animals susceptible to anthrax, and the results obtained indicate that the method is a reliable and satisfactory one.

Immunization against anthrax by the method of Sobernheim, A. STADIE (*Ztschr. Infectionskrank. u. Hyg. Haustiere, 1 (1906), No. 2–3, pp. 127–143*).—The Sobernheim and Pasteur methods of immunizing animals against anthrax were directly compared. In a case of two sheep treated by the Sobernheim method and subsequently tested with virulent cultures 4 weeks after the immunizing process, both animals died of anthrax within 5 days.

On the basis of this experiment and others with calves, the author comes to the conclusion that Sobernheim's method possesses no superiority over the Pasteur method.

The effect of sterile animal decomposition products on anthrax bacilli, C. SCHIPP (*Deut. Tierärztl. Wchnschr., 14 (1906), No. 34, pp. 405–410*).—In the experiments reported in this paper it was found that the fluid obtained from decomposing animal bodies exercises a bactericidal effect upon anthrax bacilli, even after it has been filtered so as to be free from bacteria. This effect of the decomposition fluid is not destroyed by heating to a temperature of 100° C. Anthrax spores, however, are not affected. The gases produced during decomposition of animal bodies have no effect upon the anthrax bacillus.

Inoculation with blood from animals immunized against rinderpest by the use of bile, E. RASSAU (*Ztschr. Infectionskrank. u. Hyg. Haustiere, 1 (1906), No. 4–5, pp. 383–388*).—Attention is called to the danger of using the blood of immunized animals for vaccination against rinderpest in the regions where Texas fever prevails. If such blood is used Texas fever may be transmitted to the vaccinated animals. The author states that the boundary of the region in which Texas fever occurs in South Africa is not so well defined as is the case in the United States, Paraguay, and the Argentine.

An outbreak of redwater (*Rhodesian Agr. Jour., 3 (1906), No. 5, pp. 529–531*).—In studying an outbreak of this disease it was noted that the African coast fever was not present and that the usual blood parasite was to be demonstrated in all cases.

It appears that stabled calves may be removed to infected areas in winter with impunity, for the reason that infestation with ticks takes place gradually as spring opens.

Some unusual host relations of the Texas fever tick, B. H. RANSOM (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 98, pp. 8*).—Ordinarily the Texas fever tick passes its whole life from the larval to the adult condition upon one animal, where it undergoes two molts. Other ticks closely related to the Texas fever tick differ considerably in their life history, so that a number of possible schemes of host relations may be formulated for ticks as a whole.

Experiments undertaken by the author indicate that some variations may occur in the ordinary programme as laid down for the Texas fever tick. For example, ticks removed from the host just after the first molt will develop to the adult stage if placed upon another animal within 24 hours after removal. Ticks may also be removed from one animal to another after the second molt without causing any disturbance in their life history. Ticks removed from their host just before the second molt were found to be able to molt and live unattached to any host for 2 weeks. Moreover, Texas fever ticks will attach them-

selves in a larval condition not only to cattle, horses, mules, and jacks, but also to cats and dogs.

By way of comparison notes were given on the known facts in the life history of the ticks which carry African coast fever and European piroplasmosis. In a continuation of this study an investigation will be made to determine whether the Texas fever tick is able to transmit the disease in other than the larval stage, whether other species of ticks may transmit Texas fever, and whether other animals than cattle and horses may be concerned in the dissemination of the ticks.

Vaccination for septic pneumonia in calves, GOLDBERGER (*Berlin. Tierärztl. Wchnschr., 1906, No. 27, pp. 507, 508*).—Septic pneumonia occurred in an unusually serious outbreak causing death of every calf on the estate in question within a few days after birth. The author began the use of a vaccination method applied within one day after birth and in this way prevented the further development of the disease.

Lorenz's organism of pneumonia, HOBSTETTER (*Ztschr. Veterinärk., 18 (1906), No. 27, pp. 303–305*).—The author undertook a study of a number of cases of pneumonia in horses for the purpose of determining whether the organism described by Lorenz was present in or on the skin. All tests gave negative results. Not a trace of the organism in question was found in numerous pieces of the skin taken for examination, neither was the author able to find an organism of pneumonia in the dust removed by currying infected horses.

The transmission of pleuro-pneumonia to sheep and goats, E. DUJARDIN-BEAUMETZ (*Ann. Inst. Pasteur, 20 (1906), No. 6, pp. 417–448*).—Pleuro-pneumonia is commonly considered as affecting only cattle. During the author's experiments, however, he found it possible to transmit the disease to sheep and goats in a number of cases. There seemed to be no difference in the susceptibility of sheep and goats to inoculation. When the udder of sheep was inoculated, only slight inflammation was produced, but the milk contained the virus of pleuro-pneumonia, as was shown by repeated observations.

Etiology, pathology, morbid anatomy, and other matters connected with the diseases of sheep known as louping ill and braxy, D. J. HAMILTON, J. M. MCCALL, and E. G. WHELER (*London: Bd. Agr. and Fisheries, 1906, pts. 1, pp. 36; 2, pp. 342, pls. 8, figs. 29; 3, pp. 13*).—The authors were appointed as a committee to investigate louping ill and braxy in sheep.

The symptoms of these 2 diseases are somewhat similar and the diseases are sometimes confused by those who have had little experience with them. Louping ill is confined to the British Isles, being most prevalent in the west and south of Scotland and north of England. The mortality varies from 20 to 50 per cent. Sheep of all ages are susceptible, and occasionally cattle and pigs or even geese are affected. In acute cases the symptoms are those of septicemia, and the animals live only a few hours, while in chronic cases the course of the disease may be extended for a few weeks.

Braxy is known in various parts of Great Britain, the Faröes, Ireland, and Norway. The death rate is usually 20 per cent, and at times the disease may cause almost total annihilation of a flock of sheep. The disease runs a very rapid course.

During the investigation of the committee an elaborate series of observations were made on the organisms which produce louping ill and braxy. In all cases of louping ill an organism is found in the intestines which is referred to under the name *Bacillus choreæ paralyticæ ovis*. Similarly in braxy a specific organism appeared to be the cause of the disease, and ticks apparently have no definite connection with either louping ill or braxy. No success attended the

numerous experiments of the committee in immunizing sheep to either louping ill or braxy by subcutaneous inoculations of cultures of the bacterial organisms. Treatment by means of drenching, however, was very satisfactory. This consists in adding cultures of the organisms in question to the water which is given the sheep, and in order to be successful the treatment must be applied at seasons when sheep are naturally somewhat resistant to the diseases. It is believed that this method of drenching may prove successful in the case of other diseases.

Experiments in vaccination against contagious agalactia in sheep and goats, A. Celli and D. de Blasi (*Clin. Vet.* [*Milan*], *29* (*1906*), *No. 32, pp. 769–773*).—A test was made to determine the effect of virus filtered and heated to temperatures ranging from 40 to 45° C. for a period of half an hour in vaccinating sheep and goats against contagious agalactia. It appeared, during the investigation of the authors, that goats and sheep could be completely protected in the majority of cases against subsequent infection by treatment with virus previously heated so as to attenuate it. The use of milk from cases of the disease previously rendered noninfectious gives no benefit, since such milk appears to be without immunizing power.

Malarial catarrhal fever or bluetongue of sheep, E. M. Jarvis (*Rhodesian Agr. Jour., 3* (*1906*), *No. 5, pp. 513–516*).—Bluetongue has been studied by the author during the past 5 years. The symptoms vary considerably, but there is ordinarily a high fever and inflammation of the mucous membrane of the mouth, which becomes reddish or occasionally blue. The mortality is not very high and the post-mortem findings are not striking. If the disease occurs in a virulent form it may be controlled by vaccination.

The benefits of sheep dipping, F. S. H. Baldrey (*Agr. Jour. India, 1* (*1906*), *No. 3, pp. 201–204*).—The regular periodical dipping of sheep is desirable and in many cases necessary not only in the control of sheep scab but in destroying other animal parasites which may be found in the wool and on the skin of sheep.

Pseudo-tuberculosis of sheep and its relationship to echinococci (*Deut. Tierärztl. Wchnschr., 14* (*1906*), *No. 29, pp. 346–348, figs. 2*).—The microorganism of this disease was isolated and studied in pure cultures. A number of experimental inoculations were also made, and the author gave considerable attention to a study of the distribution of the organism in the infected animals. It appeared that in certain instances the bacterial organism was carried through the cells of the intestines through the agency of echinococci carrying bacilli.

The method of vaccination for swine erysipelas, Pflanz (*Deut. Tierärztl. Wchnschr., 14* (*1906*), *No. 27, pp. 321, 322, figs. 3*).—With an ordinary hypodermic syringe considerable trouble is experienced in vaccinating hogs without hard work and the probability of becoming badly soiled. The author uses a syringe furnished with a rubber tube one-half to one and a half meters long. As soon as the needle is inserted into the skin back of the ear the hog may run about the pen somewhat but the length of the tube enables the operator to prevent the needle from being withdrawn until the serum has been injected.

A pulmonary disease of rabbits due to bacilli resembling those of swine plague, H. Selter (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 41* (*1906*), *No. 4, pp. 432–435*).—An outbreak of a pulmonary disease occurred among rabbits and was studied with the result that an organism was found which closely resembled that of swine plague and must be referred to this group of bacilli. The exact relationship between the two is not yet determined.

Atelectasis of the lungs and its relation to swine plague, Simader (*Berlin. Tierärztl. Wchnschr., 1906, No. 24, pp. 445–450, fig. 1*).—A careful study was made of the occurrence of atelectasis in the lungs of swine and other animals for the purpose of determining the conditions under which this phenomenon appears and its possible relation to the development of swine plague.

The author found that atelectasis appears in various forms, some of them being congenital and others appearing later. Atelectasis occurs frequently in all animals used for food and is usually of congenital origin. The history of cases of atelectasis varies greatly. The solid portions of the lungs thus affected may become expanded by violent inspiration of air, and a normal condition may thus be brought about. Otherwise the affected part may show a pronounced atrophy in the course of time.

The author believes that atelectasis has absolutely nothing to do with swine plague except in so far as the bacilli of swine plague may find a more favorable place for growth in the atelectatic parts of the lungs.

Notes on the etiology of swine plague, A. Stadie (*Ztschr. Infectionskrank. u. Hyg. Haustiere, 1 (1906), No. 4–5, pp. 376–381*).—According to the author's experiments, the filtered fluid obtained from the lungs of hogs affected with swine plague exercises no specific effect. In a number of experiments, during which pigs were artificially inoculated with *Bacillus pyogenes suis*, it was found that the disease thus produced was not readily transmitted from one animal to another. In fact, no such transmission took place during the period of 3 weeks in which inoculated and healthy animals were kept in close contact.

Immunization toward hog cholera by the aid of bacterial extracts, J. Citron (*Ztschr. Hyg. u. Infectionskrank., 53 (1906), No. 3, pp. 515–553*).—In a long series of experiments carried on by the author it appeared that immunity produced by aggressins and bacterial extracts is of practically the same nature and duration. Aggressins and bacterial extracts appear to be serviceable under the same conditions and likewise fail at the same points. It is shown conclusively that the immunization produced by this method is due to bacterial extracts and not to the bacterial bodies themselves. This point was demonstrated by positive results with the use of extracts and by negative results from the use of bacterial bodies after the extracts had been removed. The author believes, however, that immunization against hog cholera by means of aggressins or bacterial extracts is very unreliable as compared with results obtained by vaccination with mouse typhoid.

Active and passive immunization toward hog cholera, M. Prettner (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 1 (1906), No. 6, pp. 451–474*).—In an extensive series of experiments with mice, rabbits, guinea pigs, and swine it was found possible to produce a high degree of active immunity by the use of exudates free from the bacillus of hog cholera. Serum obtained from actively immunized animals may be depended upon to produce a fair degree of passive immunity when injected into other animals.

Feeding experiments with feces containing trichinæ, H. M. Höyberg (*Centbl. Bakt.* [etc.], *1. Abt., Orig., 41 (1906), No. 2, pp. 210, 211*).—The commonly accepted statement regarding the transmission of trichinæ is that infection takes place only after taking muscle trichinæ into the stomach and that intestinal trichinæ brought in contact with the digestive juices of another animal are destroyed. The author infected a number of brown rats by feeding them trichinous pork and subsequently used the intestinal contents of these infested rats in feeding other rats. As a result of these experiments 4 out of 5 rats became infected and it appears, therefore, that intestinal trichinæ may be in a position to infect other animals without having previously passed a period

of their life in muscle tissue. Further experiments along this line will be carried on with hogs.

The behavior of the glanders bacillus in urine and its excretion through the kidneys, G. CAGNETTO (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 41* (*1906*), *Nos. 1, pp. 21–31*; *2, pp. 173–185*).—The literature relating to the behavior of the glanders bacillus under various conditions is critically reviewed..

The author made extended observations on the action of the urine of healthy and glanderous horses upon the glanders bacillus and found that the urine from glanderous horses exercises a remarkably rapid attenuating effect upon the bacillus. In many cases the bacillus became nonvirulent within a few hours. The general statement is made that in the urine of normal horses, jacks, cats, and man, the glanders bacillus remains pathogenic for from 30 hours to 4 days, but begins to show various morphological changes before it becomes nonvirulent. In the urine of glanderous horses, however, the bacillus loses its virulence entirely within 20 hours.

With regard to the frequency of the excretion of glanderous bacilli by the kidneys the author found that in only 2 out of 50 glanderous horses, among which he made observations, was the urine virulent for laboratory animals.

The control of glanders and the use of mallein, M. SCHLEGEL (*Die Rotzbekämpfung und die Malleïnprobe beim Pferde. Stuttgart: F. Enke, 1905, pp. IV+88*).—During the author's investigations which extended over a period of several years and involved the use of mallein on more than 1,000 horses, particular attention was given to the nature of the reaction and the reliability of the mallein test as giving an indication of the proper disposal of the reacting horses.

The results obtained by the author in his various mallein tests are presented in a tabular form and clinical notes are given on many of the most interesting cases. As a result of this study the author recommends that in the control of glanders all animals in which the disease may be diagnosed by clinical symptoms should be killed immediately. All animals which have come in contact with these cases or which are otherwise to be suspected for any reason should be tested with mallein and of this number all which react in a typical manner should be killed and the premises thoroughly disinfected. Those horses which did not react should be removed to buildings free from infection after a previous disinfection of the hoofs or other parts which may have come in contact with infection.

Horses which react in an atypical manner and those which do not give a reaction but which are to be suspected in any way on account of clinical appearances should be quarantined and tested again after 1 month at which time the reactors and nonreactors are to be treated as just recommended.

Four cases of tetanus with recovery, M. MOLE (*Vet. Rec., 19* (*1906*), *No. 946, pp. 115, 116*).—Details are given regarding the symptoms of 4 cases of tetanus which were treated with antitetanus serum. Recovery took place in all cases, but after improvement appears the author recommends a dose of carbolic acid. It is suggested that the usual dose of 10 cc. be divided and given twice per day.

Infectious inflammation of the spinal cord in the horse, M. SCHLEGEL (*Berlin. Tierärztl. Wchnschr., 1906, No. 25, pp. 463–475, pl. 1*).—The author has had occasion to study this disease for a number of years in several localities in Germany and presents the results of his investigations in considerable detail.

The disease affects horses of all ages and both sexes. It is due to *Streptococcus melanogenes* and is sometimes referred to as a streptococcic septicemia. In a majority of cases the disease ends fatally within a few days, but occa-

sionally it may run a chronic course extending over 1 to 3 weeks. Horses affected with this disease become emaciated and anemic. The blood appears to be paler than usual and does not readily coagulate. The liver is greatly enlarged, hyperemic, and softened. The chief lesions in the spinal cord are seen in the pia mater. No satisfactory treatment has been devised, but the disease may be prevented from spreading by the use of strict quarantine measures.

Negri's corpuscles and infection with rabies, A. BONGIOVANNI (*Centbl. Bakt. [etc.], 1. Abt., Orig., 41 (1906), No. 3, pp. 343–352*).—In the author's experiments with laboratory animals, chiefly rabbits, he was quite unable to find Negri's corpuscles in any part of the nervous system of any animal after infection with rabies, either from laboratory or street virus. It would appear, therefore, that complete reliance can not be placed on Negri's corpuscles in the diagnosis of this disease.

The cause of roup, R. MULLER (*Centbl. Bakt. (etc.), 1. Abt., Orig., 41 (1906), Nos. 4, pp. 423–426; 5, pp. 515–523; 6, pp. 621–628*).—The author made a bacteriological study of several cases of roup in fowls. A bacillus was found that grows readily on blood-agar and which appears to be closely related to the bacillus of human diphtheria. Notes are given on the behavior of this bacillus when cultivated on different kinds of nutrient medium.

By means of inoculation experiments the author found it possible to produce roup artificially in laboratory animals, with symptoms essentially the same as are observed in spontaneous cases of the disease. The bacillus of roup appears not to form a toxin. It may be destroyed by subjection to a temperature of 58° C. for one-half hour. The bacilli, however, are quite resistant to ordinary disinfectants, and a thorough use of such materials is required in order to eradicate an infection with this disease.

Spirillosis of fowls, LEVADITI and MANOUELIAN (*Ann. Inst. Pasteur, 20 (1906), No. 7, pp. 593–600*).—A detailed study was made of the pathological histology of spirillosis as produced in fowls by *Spirillum gallinarum*.

It appears from this study that the septicemia caused by the organism in question is not due entirely to the multiplication of micro-organisms in the blood, but that the parasite infests a number of glandular tissues, including the liver and spleen. In the presence of *Treponema pallidum* the micro-organism appears not to penetrate into the protoplasm of the cells. The spirillum which causes the disease in question is capable of entering and infecting the eggs in the ovary. A favorable turn of the disease at the crisis is due to the destruction of the spirillum by the large leucocytes of the spleen and liver.

Do the bacteria of fowl cholera occur in the intestines of healthy geese? R. OSTERTAG and P. ACKERMANN (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 1 (1906), No. 6, pp. 431–441, fig. 1*).—It is sometimes believed that fowl cholera may break out as the result of hardships suffered by the fowls and that therefore the organism of the disease must have been present in the alimentary tract during apparent health. This matter was investigated by the authors with the result that the bacteria of fowl cholera were not found in the intestines of healthy geese or fowls. The disease did not develop in birds which were kept in cages for 5 or 6 days under unfavorable conditions and without food or water.

The incubation period of the disease and the length of the course of fowl cholera varies considerably. Geese may die as the result of eating one meal containing fowl cholera bacilli, and death may take place in from 2 to 10 days. The incubation period in geese is usually 1 to 2 days and in chickens 4 to 9 days.

The disinfection of stables, C. M. HARING (*California Sta. Circ. 19, pp. 3*).—The purposes and meaning of disinfection are briefly discussed and suggestions are made regarding sanitary methods of cleaning and disinfecting stables.

RURAL ENGINEERING.

History of rural engineering, Chaldea and Assyria, M. RINGELMANN (*Ann. Inst. Nat. Agron., 2. ser., 5 (1906), No. 1, pp. 85–139, figs. 52*).—In this article the author discusses the agricultural machines and rural engineering works of the ancients so far as knowledge concerning them can be gained from inscriptions, relics, and other sources of information. He treats of their agricultural implements, such as plows, hand tools, grinding mills, etc., their methods of using them, their means of transportation by sledges, wheeled vehicles, and rafts of inflated sheepskins, together with a description of the form of harness used on horses and oxen, and the status of the slaves, by whom agricultural operations were carried on.

Irrigated agriculture in Egypt in ancient times, A. DE CERIS (*Jour. Agr. Prat., n. ser., 11 (1906), No. 23–24, pp. 720–725, figs. 7*).—This is a chapter from A Study of the History of Rural Engineering, by M. Ringelmann, reviewed above, in which, from an exhaustive study of Egyptian documents and other data, he has been able to determine in great detail the system of irrigation and crop culture practiced by the ancient Egyptians.

The author finds that "after having protected the valley against the floods of the Nile by insubmergible dikes, parallel to the river, they had increased the zone capable of submersion by a number of canals, of which it is still possible to find the remains. This indicates to what degree the departments of rural engineering relative to embankments, basins of inundation, and drainage had been carried."

Irrigation in Montana, S. FORTIER, A. P. STOVER, and J. S. BAKER (*U. S. Dept. Agr., Office Expt. Stas. Bul. 172, pp. 108, figs. 18*).—The object of this bulletin is to present the present status of irrigation in Montana in its engineering, agricultural, and legal aspects.

The method employed was to study these various features in typical sections, rather than to attempt to cover the whole State. In their study of conditions in Montana the authors paid special attention to the means of bringing about the more economical use of the water supply, which would make possible the largest development of the State's agriculture.

The most conspicuous sources of waste were poorly constructed ditches, poorly prepared fields, careless use of water, and lack of public supervision of the acquirement of rights and of the distribution of water. Owing to the large supply of water, as compared with the present demand, there has been an indifference to these things, especially the need of legislation creating such public control as will insure the peaceable enjoyment of the rights to water, which is necessary to the highest development. In his conclusions Professor Fortier makes certain recommendations regarding such legislation.

Punjab irrigation branch papers (*Punjab Irrig. Branch Papers, No. 11, pp. 109, dgms. 7*).—This bulletin consists of three reports, (1) Lining of Water Courses for Prevention of Absorption; (2) Waste of Water by Cultivators in Irrigating their Fields; (3) Number of Waterings required for Wheat Crops.

The experiments on ditch lining were carried on in parallel trenches, 24 ft. long, the loss by seepage being read with hook gauges. Evaporation was measured separately and allowed for. Crude oil, cement, lime, coal tar, and clay puddle were applied in various combinations. Oil was found to be most

effective, reducing the loss over 90 per cent in some cases. Cement and coal tar are next in efficiency, while lime and clay puddle are least effective, the latter reducing seepage about one-half. Hand methods only were employed, the lining being mixed thin and spread from a pail handled by one man. Owing partly to the tendency of thin cement mortar to settle and to its great weight, it was found to be much more expensive to apply than the oil, which runs freely at a moderate temperature. Oil and tar were applied to a depth of $\frac{1}{32}$ in. for each coat, being dusted over with damp earth at once and protected by a backfilling of earth to a depth of 8 to 18 in. Neat cement was applied $\frac{3}{64}$ to $\frac{1}{16}$ in. thick for each coat, two coats being used. Lime paste was put on in one coat $\frac{1}{8}$ in. thick. Clay was mixed thin and spread by hand from pans in three layers, giving a total thickness of $\frac{3}{4}$ in.

All the linings were covered with a foot or more of earth which was settled with water, after which the channel was reexcavated to its desired size. It is proposed to continue these experiments for several years, as the most important consideration is the durability of the linings used.

The experiments to determine waste were made on grain fields, experimental plats being selected adjoining fields irrigated in the usual manner. The only difference in the method of application lay in the use of smaller checks on the experimental plats. The excess used by the cultivators was 41 per cent for the first watering, 24 per cent for the second, 20 per cent for the third, and 30 per cent for the last. The total depth applied was 0.81 ft. on the plats and 1.05 ft. in the fields. The yield of grain was not materially different on account of the amount of water applied.

The experiments to determine the number of irrigations for wheat showed that three irrigations would produce a full crop and that more than four were a positive injury.

An investigation of the natural basis of irrigation farming in North America, A. Golf (*Inaug. Diss., Univ. Halle-Wittenberg, 1903, pp. 87*).—A study of the topography, climate, soil, and water resources of the arid region of the United States in their relation to irrigation.

Design and construction of small irrigation canals, W. L. Strange (*Transvaal Dept. Irrig. and Water Supply Bul. 2, pp. 75, pls. 39*).—This is a series of notes dealing with the subject in a brief but comprehensive way, numerous and valuable practical suggestions being given. In an appendix are included tables of canal discharges based on Bazin's formula and a number of drawings of canal structures in plan, elevation, and section.

The utility of wind power in agriculture (*Impl. and Mach. Rev., 32 (1906), No. 377, p. 555*).—In commenting upon the uses to which wind power can be put it is suggested that in sawing wood by the aid of a windmill a 24-in. saw blade be used with a 12 to 14 ft. wheel and a 28-in. with a 16-ft. wheel. It is asserted that a 12-ft. windmill will furnish sufficient power to saw 12 to 15 cords per day, and that the same mill in a fair wind will grind 12 to 15 bu. of grain per hour.

The demand for windmills in British South Africa (*Masch. Ztg., 4 (1906), No. 10, p. 117*).—For several years past there has been an agitation in South Africa to undertake the irrigation of extensive tracts of land in that country. Owing to a general business depression these plans have failed of execution, but an impetus has been given to private enterprise by which some excellent results have been obtained. In this connection there is a constant demand for windmills, most of which are imported from the United States.

The mills which have been sent are, according to the writer, far from being modern in design, of faulty construction, and unsuited to the needs of the

country. Mills which disappeared from our markets 20 years ago are yet being sold in South Africa. Some of these are so poorly built that it requires a strong wind to turn them; in others the towers are so weak that they are unable to resist storms. The mill for the irrigation of a small farm in South Africa must be designed to lift enough water from a depth of 25 to 30 ft. to cover daily 1 acre of land with water to a depth of 3 in. Further considerations are ease of erection, simplicity of mechanism, and automatic regulation as far as possible.

The usual wind velocity observed along the seacoast and in exposed places is 12 to 18 miles per hour; in the interior, 8 miles per hour.

The difficulty of surveying deep bore holes (*Engin. Rec., 54 (1906), No. 4, p. 87*).—A method is described in which the difficulty is surmounted by the use of photography.

Fourth annual report of the State board of public roads of the State of Rhode Island, 1906 (*Ann. Rpt. Bd. Pub. Roads R. I., 4 (1906), pp. 37, pls. 39*).—An account of the work accomplished and in progress under the Rhode Island "good roads law."

The road drag for improving earth roads (*Engin. News, 55 (1906), No. 24, pp. 666, 667, figs. 2*).—The Illinois Highway Commission recommends a light road drag for improving the condition of muddy roads; the lighter and more simple the drag, the greater its effectiveness.

A form recommended is that consisting of two split logs 10 and 12 in. in diameter and 9 ft. long, held parallel to each other and about 3 ft. apart by suitable braces. A chain is attached with a short and long hitch so that the drag travels at about 45° to the direction of the road. The flat surface of the split logs is on the forward side, and the lower edge should be protected by a strip of wagon tire. More complicated forms of drags are shown and the theory of road dragging explained.

Roads and tires (*Engin. Rec., 54 (1906), No. 4, p. 87*).—Reference is made to the increasing difficulty in designing and maintaining good roads suitable for all kinds of traffic. It is pointed out that while a smooth, hard surface, such as a steel roadway, might be ideal for the use of heavy freight traffic, it would be poorly adapted for the rubber tires of motor cars, which slip on smooth wet surfaces. Although a macadam pavement is excellent in affording a bite or grip for traction purposes, it is very rapidly worn out, since the binding material is swept out as dust or mud under the action of motor-car tires. It is suggested that the solution of the difficulty may be found in elastic but solid tired wheels, a more resilient roadbed, or a combination of both.

The application of electric motors to agricultural operations, F. Koester (*Engin. Mag., 31 (1906), No. 5, pp. 655–667, figs. 15*).—An article descriptive of the use of electric power in agricultural operations on farms in Europe, with some arguments as to its advantages, mainly from the standpoint of ease of distribution and lessened fire hazard. Little data are given as to economy, but this may well be questioned for any but the most extensive undertakings in the light of the fact that the first cost of a plow system averages about $10,000.

Denatured alcohol, its use in Germany and France (*Daily Consular and Trade Rpts. [U. S.], 1906, No. 2662, pp. 1–11*).—An article prepared by the consuls-general of Berlin and Paris in response to the generally expressed desire for information on the subject.

Statistics are given showing that in Germany a large proportion of the alcohol output is derived from potatoes, the production of which for this purpose is the chief support of many of the farming regions remote from business centers.

It is found that it requires 1.26 bu. of potatoes to produce 1 gal. of pure alcohol. The cost is difficult of determination, depending upon a variety of factors such as the size of distillery, efficiency of apparatus and methods, and upon the disposal of by-products. Statistics are given relating to the use of alcohol for drinking and industrial purposes, to the use of incompletely denatured alcohol, and the consumption of tax-free alcohol. The methods of denaturing are discussed, and systems of distribution and government control described.

In the case of France, similar information is given, with description of the methods pursued by the Government in the attempt to extend the use of the denatured product. Its use seems not to have been attended with much success as a fuel, either for lighting or power. Although it was found by experiment to be a pure and economical fuel, it required a special type of engine and was found to erode valves and cylinder surfaces. When used in lamps it was attended with no success whatever, due probably to the ineffective character of the apparatus.

Royal agricultural show (*Engineer* [*London*], *102* (*1906*), *No. 2636, pp. 16–18, figs. 8*).—A description of various types of road locomotives and power machinery exhibited at the Derby show. A gas-producer test is mentioned in which the consumption of anthracite pea coal was 0.785 lb. per brake horsepower per hour.

Cylinder cooling in the alcohol engine (*Engin. Rec., 54* (*1906*), *No. 4, p. 87*).—It is asserted that the flame of burning alcohol radiates heat less rapidly than that of gasoline and that, therefore, the problem of cooling the cylinders of alcohol motors will be less difficult than with those using gasoline.

The efficiency of suction gas plants: Remarkable results (*Impl. and Mach. Rev., 32* (*1906*), *No. 374, pp. 188, 189*).—The saving effected by the use of these plants and gas engines over the old steam plants, as given by various users, amounts to 75 to 80 per cent.

Farming by steam power, J. L. Donahue (*Threshermen's Rev., 15* (*1906*), *No. 9, p. 7*).—A problem in connection with farming in the semiarid lands of Colorado and New Mexico is the breaking up of the largest possible area in the limited time during the early spring when the ground is in condition to plow. It is equally important that this ground be packed and harrowed simultaneously with the plowing in order to conserve the soil moisture. To solve this problem and at the same time reduce the expense to the minimum, steam power has been employed with considerable success. A 32-horsepower engine pulled 8 14-in. moldboard plows, 2 corrugated iron rollers, 2 harrows, and 2 seed drills, by which it was possible to plant 12 acres in peas per day of 10 hours, at an expense of \$25 per day. Without the seeders 20 acres could be plowed, packed, and harrowed per day at an expense of \$1.25 per acre. With ground in less favorable condition the expense is greater.

The chief factors of cost in operation are coal and the hauling of water. It is suggested that the use of the alcohol engine may reduce the probable cost of operation to 50 cts. per acre.

Steam plows used (*Farm Machinery, 1906, No. 767, p. 24*).—It is asserted that by the use of steam plows and other labor-saving devices an increase in yield of sugar cane of 50 per cent has been effected in Trinidad, thus assuring the continuance of an industry which was in danger of becoming extinct through the effects of competition of Cuba and Porto Rico.

The draft of plows (*Threshermen's Rev., 15* (*1906*), *No. 8, p. 20*).—In an article copied from the *Country Gentleman* tables are compiled from the results of draft trials made in England and this country, which show the total number of

pounds required to pull a 14-in. plow cutting furrows of different widths and depths, together with the horsepower required at a rate of movement of $2\frac{1}{2}$ miles per hour.

Stone-gathering machines, W. L. SUMMERS (*Jour. Dept. Agr. So. Aust., 9 (1906), No. 12, pp. 786, 787*).—The writer describes the efforts being made in South Australia to evolve an effective machine which would remove loose stumps and stones from cultivable land, thereby reducing the cost of clearing. Although prizes were offered and several trials held, no machine has yet been designed which will meet the requirements.

A machine for picking cotton (*Queensland Agr. Jour., 17 (1906), No. 2, pp. 106–108, pls. 2*).—The construction, operation, and efficiency of a cotton-picking machine invented by George A. Lowry are discussed.

Implements and machinery at the Suffolk show (*Impl. and Mach. Rev., 32 (1906), No. 375, pp. 320–325, figs. 11*).—The results of tests of a large number of various agricultural tools are given, one trial of especial interest being in the showing made by a $1\frac{1}{2}$-ton tractor driven by a petrol or paraffin motor. This machine plowed an acre of light dry soil in $2\frac{1}{4}$ hours, using 6 gal. of petrol and hauling a 3-furrow plow. The same machine subsequently operated a thrashing machine, pulled in turn a $4\frac{1}{2}$-ton load, a 7-tine cultivator, and two 6-ft. mowers.

Some observations in the farm machine and implement section of the D. L. G. exhibition at Berlin-Schöneberg, G. KÜHNE (*Masch. Ztg., 4 (1906), No. 14, pp. 158–162*).—A large number of tools, implements, and prime movers are mentioned and briefly described.

Of special interest among the latter are portable farm engines of from 8 to 26 horsepower, using producer gas on the suction principle. In this type of machine a gas producer, together with its scrubber and cooler, is made a part of the equipment, and with the engine is mounted on a strong four-wheeled wagon. The producer is adapted for anthracite coal or coke, as well as for peat, lignite, and wood. The coal consumption guaranteed is 0.6 kg. per horsepower hour for machines of from 8 to 12 horsepower.

In order to be able to compete with an equipment showing such notable economy manufacturers of steam engines are improving their designs, and a portable steam plant is described in which a 120-horsepower compound engine uses superheated steam and is provided with a condenser. By this equipment a saving of 40 per cent in fuel and 24 per cent in water consumption is effected over the same size machine using saturated steam.

A portable apparatus for farm-power purposes, in which is combined a gasoline engine, a set of storage batteries, and dynamo-motor, is described, as is also a small explosion motor in which there are certain novel features, notably a peculiar adjustable cylinder lining, making piston rings unnecessary.

Cement mortars, M. RINGELMANN (*Jour. Agr. Prat., n. ser., 12 (1906), No. 29, pp. 76–78*).—Directions as to the proportions and methods of using mortars made with lime and hydraulic cements. When using quicklime the proportions recommended for masonry are: Lime, 1 volume; coarse sand, 2 to 2.5 volumes. For plaster, lime, 1 volume; medium or fine sand, 0.5 to 1 volume.

When using hydraulic or Portland cement the following is recommended: For ordinary masonry foundations, pavements, and plaster, use 1 volume of cement to 3.3 volumes of medium-sized river sand. For a very energetic mortar, use 1 volume of cement to 1.8 to 2.6 volumes of fine sand. For mortar to be used under water, use 1 volume of cement to 1.5 volumes medium river sand.

What the farmer can do with concrete, C. H. MILLER (*Farming, 2 (1906), No. 2, pp. 11–13, figs. 14*).—A popular article on the varied applications of con-

crete on the farm and the advantages following its use. Among the uses enumerated are foundations for houses, barns, and windmills, sidewalks, fence posts, water troughs, cisterns, tanks, and cesspools, floors for house and stable, stairs, well curbs, stalls, hog pens, chicken houses, corncribs, ice houses, incubator cellars, mushroom cellars, hotbed frames, bridge abutments, chimneys, ventilators, and hitching posts.

Attention is called to the fact that in estimating on cost of concrete sufficient broken stone should be provided to fill the whole volume under estimate, since the cement and sand merely fill the voids in the broken stone.

A calculation is given of the cost of concrete posts, by which it is found that posts can be made for 14 cts. each. It is explained, however, that this low cost would be possible only when large numbers of posts are made.

Detailed bill of material for storage barn, sheds, feed lots, and other equipment for feeding experimental cattle in carload lots, H. W. Mumford and E. S. Good (*Illinois Sta. Circ. 104, pp. 10*).—A circular supplementing Bul. 110 of the Illinois Experiment Station and giving a detailed bill of material used in an experimental cattle-feeding plant.

RURAL ECONOMICS.

Changes in farm values, 1900–1905, G. K. Holmes (*U. S. Dept. Agr., Bur. Statis. Bul. 43, pp. 46*).—Detailed statistical data on this subject are reported. The analysis, economic causes, and character of the results of this investigation have been previously noted from another source (E. S. R., 18, p. 291).

Local conditions as affecting farm values, 1900–1905 (*U. S. Dept. Agr., Bur. Statis. Bul. 44, pp. 88*).—This bulletin consists of a partial reprint of an article from the Yearbook for 1905 (E. S. R., p. 291) with selected statements from reports of 45,000 crop correspondents which show "the local conditions affecting values of farms in all parts of the country." The statements in general apply to medium-size farms, cover five years, and are grouped into counties and States under geographical divisions of the United States.

Report and scheme of national land settlement, H. R. Haggard (*London: Govt., 1905, pp. VIII + 74*).—The contents of this report have already been noted from another source (E. S. R., 17, p. 816).

Agricultural settlements in British colonies (*London: Dept. Com. Agr. Settlements Brit. Colonies, 1906, vols. 1, pp. IV + 41; 2, pp. IV + 381*).—In January, 1905, Mr. H. R. Haggard was appointed special commissioner by the British government to investigate and report on the Salvation Army agricultural colonies established in the United States and at Hadleigh, England, with a view of suggesting some scheme for the settlement on agricultural land in the colonies of poor individuals and families from British cities (see above).

The report of the committee appointed by the British government to consider the plan suggested by the special commissioner is given in volume 1 of this publication, together with notes and memoranda by individual members of the committee bearing on certain phases of the subject. The report treats of the history of British agricultural colonies during the nineteenth century in Canada, South Africa, and Australia; outlines and discusses the scheme for agricultural settlements proposed by Mr. Haggard; reviews the evidence of witnesses who testified before the committee as to the respective merits of colonization and emigration; and enumerates the reasons why the scheme for national land settlement proposed by the commissioner should not

be adopted by the British government. While unable to indorse any plan of colonization at the present time, the committee makes several recommendations relative to the government giving financial aid to emigration societies, selection of colonies for emigrants, supervision of emigration, and the emigration of soldiers whose term of service has expired.

Volume 2 consists of a complete record of the evidence taken before the committee which forms the basis of the report, together with 23 appendices bearing upon various phases of emigration, agricultural statistics, colonization schemes, etc., a detailed analysis of the evidence, and an index.

Land settlement, agriculture, and live stock, E. G. STENBERG (*Statis. Reg. West. Aust., 1904, pt. 5, pp. 72, map 1*).—Statistics for the year 1904 in comparison with similar data for the years 1895 to 1904 are published from official governmental returns without comment.

The data relate to the occupation of land in Western Australia, areas open for selection, land improvements, and other subjects relating to land settlement; the areas under crops, total and average yields, kinds of field crops and fruits, cereal production, fertilizers, irrigation, dairying, poultry raising, bee raising, employment and wages of farm labor, prices of farm products, and related agricultural topics; and the number and classification of live stock, number slaughtered and lost from various causes, and the number and value of imports and exports of live stock.

The development of agriculture in Denmark, R. J. THOMPSON (*Jour. Roy. Statis. Soc., 69 (1906), No. 2, pp. 374–411*).—This is a paper read before the Royal Statistical Society of London in May, 1906.

Statistics are presented and discussed on the historic development in Denmark of systems of land tenure, size of holdings, cultivated areas, live stock, trade in agricultural produce, prices, cooperation, and labor, the data in general being compared with similar data relating to Great Britain. The present condition of agriculture in Denmark is said to be highly prosperous, and this prosperity is assigned to three causes, namely: (1) Land tenure, which has created a homogeneous farming community who, as owners of the soil, cultivate farms of moderate size; (2) education, which by means of elementary, technical, and adult continuation schools has produced the most enlightened peasantry in the world; and (3) cooperation, which by promoting the production and sale on a large scale of agricultural products for exportation abroad has fulfilled the aim of Danish agriculture.

Cooperative credit in Bengal, W. R. GOURLAY (*Agr. Jour. India, 1 (1906), No. 3, pp. 216–219*).—The author briefly describes the plan adopted by the imperial and provincial departments of agriculture of India in promoting agricultural credit banks in the provinces.

The system consists primarily in making village societies rather than individual peasants responsible for borrowing, disbursing, and collecting principal and interest on loans, which are advanced at rates ranging from 6 to 12½ per cent interest instead of from 25 to 50 per cent as charged by money lenders. There are at present 86 experimental village societies in Bengal, and more than 60 of these are said to be working on sound principles. The results, says the author, "show that we are on the road to a successful solution of the problem of financing agriculture." Notes are also given on the institution of banks for advancing seed grain to agriculturists.

Imports of farm and forest products, 1903–1905 (*U. S. Dept. Agr., Bur. Statis. Bul. 45, pp. 62*).—Detailed statements of imports of farm and forest products, including the countries from which consigned, are reported. The following table summarizes the value data:

Values of farm and forest products imported into the United States.

Kinds of imports.	Year ended June 30—			Total, 1903–1905.
	1903.	1904.	1905.	
Farm products	$456,199,325	$461,434,851	$553,851,214	$1,471,485,390
Forest products	71,478,022	79,619,296	92,680,555	243,777,873
Total	527,677,347	541,054,147	646,531,769	1,715,263,263

Exports of farm and forest products, 1903–1905 (*U. S. Dept. Agr., Bur. Statis. Bul. 46, pp. 72*).—Detailed statements of exports of farm and forest products, including the countries to which consigned, are reported. The following table summarizes the value data:

Values of farm and forest products exported from the United States.

Kinds of exports.	Year ended June 30—			Total, 1903–1905.
	1903.	1904.	1905.	
Farm products	$878,480,557	$859,160,264	$826,904,777	$2,564,545,598
Forest products	58,281,124	70,085,789	63,199,348	191,566,261
Total	936,761,681	929,246,053	890,104,125	2,756,111,859

Trade with noncontiguous possessions in farm and forest products, 1903–1905 (*U. S. Dept. Agr., Bur. Statis. Bul. 47, pp. 45*).—The value of farm and forest products shipped from the United States to Porto Rico, Alaska, Hawaii, Philippine Islands, Tutuila, Midway Islands, and Guam in 1905 was $15,851,726, as compared with a value of $15,154,837 in 1904; while the shipments from noncontiguous possessions to the United States amounted in value to $61,699,925 in 1905, as compared with $46,898,012 in 1904. Data as to the quantity, value, and destination of the various products are reported in detail.

Retail prices of food, 1890 to 1905 (*Bur. of Labor* [*U. S.*] *Bul. 65, pp. 171–316*).—Statistical data of the retail prices of 30 staple foods secured in the principal industrial centers of 40 States, including the District of Columbia, are reported. For the United States as a whole the average cost of food per family ranged from $296.76 in 1896, the year of lowest prices, to $349.27, the highest, in 1905, a difference of 17.7 per cent. As determined from 2,567 families furnishing information in 1905, the cost of food represents 42.54 per cent of all family expenditures.

Russia's wheat surplus; conditions under which it is produced, I. M. Rubinow (*U. S. Dept. Agr., Bur. Statis. Bul. 42, pp. 103, pls. 4, fig. 1*).—The author describes the conditions under which wheat is grown and harvested in Russia and points out the actual and possible exportations of wheat to European markets where it competes with wheat from other countries.

In the course of this study detailed facts are presented regarding the population and physical conditions of the country, system of land ownership, cereal production, the agricultural methods in vogue on private and peasant farms, and the wages of agricultural laborers, many of which factors bear upon the cost of wheat production. The two competing cereals in Russia are rye and wheat, and statistics are presented showing a steady gain in the cultivation of wheat. While the rye is consumed for bread by the peasants most of the wheat is marketed.

The primitive methods of agriculture, lack of modern implements and machinery, ignorance of the peasantry, and excess of spring sowings over

winter sowings are regarded as factors in lowering the yield of wheat. "Notwithstanding the exceptional fertility of the black soil which covers nearly the whole of the Russian wheat belt, the yield of wheat in Russia is found to be invariably smaller than in any country, with the possible exception of Argentina. . . . On the whole a spring yield of 8½ bu. per acre and a winter yield of 11½ bu. seem to be normal for the Russian Empire, with a grand average of a little over 9 bu."

From a commercial standpoint wheat is not regarded as low in cost of production under Russian conditions, the cost of raising winter wheat ranging from 46.5 to 66.6 cts. per bushel. "Excluding Poland, the average cost in European Russia proper varies between 46 and 54 cts. a bushel." The cost of spring wheat varies between 40 and 53 cts. per bushel.

In the opinion of the author the future development of the wheat-growing industry in Russia will depend upon the improvement of the economic and social conditions of the people by increasing the allotments of land to peasants, by better educational systems, and particularly by overcoming the greatest obstacle of all—the extreme poverty of the peasant.

[The sugar industry in Brazil] (*Internat. Sugar Com. [London], Proc. Spring Sess., 1906, pp. 36*).—This publication mainly consists of reports by several Belgian consuls residing at different places in Brazil and by the British vice-consul located at Rio de Janeiro which give statistics regarding the cost of production, quantity, and prices of grades of sugar, freight rates, export and import duties, etc. General information relating to methods of manufacture, shipping, and marketing sugar, as well as the part the Brazilian government has played in promoting the sugar industry, is included.

Season and crop report for the Province of Bengal for the year 1905–6 (*Dept. Agr. Bengal, Season and Crop Rpt., 1905–6, pp. 25*).—Data are presented on the character of the seasons; area cultivated, cropped, and irrigated; production per acre and total production; prices, trade, and stock of food grains and other products; number of live stock and implements; and condition of the agricultural population.

MISCELLANEOUS.

Eighteenth Annual Report of Maryland Station, 1905 (*Maryland Sta. Rpt. 1905, pp. XX + 240*).—The report proper contains the organization list, a report on the work and expenditures of the station during the year, and a financial statement for the fiscal year ended June 30, 1905. Reprints of Bulletins 94–103 of the station previously abstracted are appended.

Nineteenth Annual Report of Maryland Station, 1906 (*Maryland Sta. Rpt. 1906, pp. XII + 126*).—This contains a report on the work and expenditures of the station by the director, a financial statement for the fiscal year ended June 30, 1906, and reprints of Bulletins Nos. 104–109 of the station previously noted.

Agriculture in other lands with special reference to dairying, J. A. KINSELLA (*Wellington: New Zeal. Dept. Agr., 1906, pp. 90, pls. 30*).—Observations made by the author in Great Britain, Denmark, Canada, South Africa, and Argentina are reported.

Farm science (*Chicago: International Harvester Co., 1906, pp. 128, figs. 60*).—This contains practical discussions of the following subjects: Alfalfa culture in America, by J. E. Wing; modern corn culture, by P. G. Holden; best methods in seeding, by W. F. Brown; small grain growing, by W. M. Hays; profitable hay making, by T. Shaw; up-to-date dairying, by C. D. Smith; increasing fertility, by C. G. Hopkins; and power on the farm, by F. R. Crane.

NOTES.

Florida University and Station.—R. W. Clothier, erroneously announced in a previous issue of the Record as the successor to C. M. Conner in the university and station, has been appointed professor of agriculture and horticulture in the university only. The position of agriculturist in the station has not yet been filled. R. Y. Winters, a graduate of Clemson College, has been appointed assistant in botany.

Georgia Station.—The station has recently erected a new laboratory building for the use of the new departments of bacteriology and plant breeding and plant pathology.

Idaho University.—A school of agriculture has been established, providing a 4-year course preparatory to the regular college work. A 4-year course in domestic economy is also announced.

Purdue University.—Farm mechanics has been added to the curriculum of the school of agriculture. It is to include class-room and laboratory practice in the subjects of farm machines, roads, buildings, and drains.

Iowa College and Station.—The department of agricultural extension, established as recently noted in charge of P. G. Holden, has been organized as follows: M. L. Mosher, in charge of farm crops; P. K. Bliss, in charge of animal husbandry; A. H. Snyder, in charge of soils; J. C. Guthrie, in charge of dairy; J. W. Jones, in charge of horticulture; Miss Mary F. Rausch, in charge of household economics; and G. E. Stayner, secretary.

In accordance with a law passed by the last legislature, facilities for instruction and research in cement and clay products have been provided, and 4-year and 2-year courses are being offered.

According to the *Iowa Agriculturist*, H. J. Quayle has resigned to continue entomological work at the University of California, and is succeeded by C. E. Bartholomew.

Maryland College.—The general agricultural course has been subdivided and separate courses are now offered in agronomy and animal industry, horticulture, and chemistry.

Montana College.—The general agricultural course has been expanded into separate courses in agronomy, animal husbandry, dairying, and horticulture. A 3-year elementary course in agriculture, continuing for 6 months of the year, has been offered in the newly created school of agriculture, to take the place of the 2-year winter course.

Nebraska University.—It is noted from *Science* that at a recent meeting of the regents of the university, the grade of "head professor" was established. Among the appointments made under this title were C. E. Bessey (botany), Lawrence Bruner (entomology), H. B. Ward (zoology), O. V. P. Stout (civil engineering), E. A. Burnett (animal husbandry), A. T. Peters (animal pathology), and Samuel Avery (chemistry). Most of the above are or have been connected with the station. It was further ordered that these head professors should constitute the "university senate."

New Mexico Station.—J. D. Tinsley, head of the department of soils, has been appointed superintendent of farmers' institutes and cooperative experiments, and will spend the greater portion of the year in traveling over the Territory organizing this work. George M. Lummis has been appointed assistant in the

department of soils and will have charge of the college classes and the experimental work. J. B. Thompson, recently appointed assistant in horticulture, has resigned to accept a position in the Philippine department of agriculture, and is succeeded by Lorenz Greene, a graduate of the Kansas College. It is planned to add an irrigation engineer to the station staff in the near future.

Cornell University and Station.—H. J. Webber, in charge of plant-breeding work in this department, has been appointed professor of plant biology, and will enter upon his new position in the spring. J. E. Coit, J. P. Stewart, and W. H. Griffiths have been added to the department of horticulture.

Oregon College.—A 4-year course in forestry, leading to the degree of B. S., has been added to the curriculum.

Pennsylvania College and Station.—Thomas F. Hunt, of Cornell, has been appointed dean of the college of agriculture and director of the station. He will continue in his present position until the close of the college year, giving a part of his time to planning for the future development of the work in Pennsylvania.

Vermont University and Station.—C. L. Beach, in charge of dairying at the Connecticut Storrs College and Station, has been placed in charge of the work in dairy husbandry in the Vermont University and Station. A. P. Bigelow, a former student at the dairy school, will be dairyman at the station, vice C. L. Stygles, resigned. It is expected rapidly to increase the work in diarying.

Armour Scholarships.—At a joint meeting of representatives of many of the agricultural colleges and the managers of the International Stock Show plans for the distribution of the Armour scholarships were decided upon. One scholarship will be given to each college leading at the exposition in judging horses, cattle, swine, sheep, and corn, one to the college making the best exhibit of feed stuffs, and one to the college making the highest average. The remaining 13 will be apportioned according to the winnings of the colleges at the show, except that no college may receive more than 40 per cent of the total number. The awarding of the scholarships to students will be done by the respective colleges.

Madras Agricultural College.—A new agricultural college and research institute for Madras is now in course of erection. In 1905 a grant to the presidency by the government of India of $50,000 per annum, which was subsequently increased to $100,000, added to the allotment made by the government of Madras removed all financial difficulty experienced by the Madras agricultural department. The result of this improved financial condition was the decision of the government to close the agricultural college at Saidapet and establish a new college and research institute, adequately equipped with laboratories and classrooms and with a suitable farm near Coimbatore.

The staff will consist of an expert agriculturalist as the principal of the college, a superintendent of the central farm, a government botanist, and an agricultural chemist. Ultimately an entomologist and mycologist may be added. The staff will combine teaching with research work. Problems connected with the agriculture of the presidency will be studied in the laboratory and the field, while the students will be given a general education in all branches of agricultural science.

Vacation Forestry Excursions.—The Royal Agricultural College of Cirencester has instituted for its forestry students a series of annual vacation excursions to the German forests. The initial excursion included visits to the Oberförsterei of Darmstadt, the oak and pine woods of Viernheim, the large coppice in the Odenwald now under conversion to high forests, and some of the Heidelberg woods. Shorter excursions to forest areas in England and Wales are frequent during the college year.

Association of Official Agricultural Chemists.—This association held its

twenty-third annual convention in Washington, D. C., November 7–9, 1906. The meeting was well attended. Prof. W. M. Hays, Assistant Secretary of Agriculture, Prof. C. E. Munroe, of the George Washington University, and Prof. Alexius de Sigmond, of Budapest, Hungary, upon invitation of the association, delivered brief addresses appropriate to the occasion.

The presidential address of C. G. Hopkins was entitled, "The Duty of Chemistry to Agriculture." This dealt mainly with the question of soil fertility, and included a review of investigations by the Bureau of Soils of this Department, work of the experiment stations in Illinois, Minnesota, and Ohio, and data obtained at Rothamsted.

In the following note concerning the proceedings no effort is made to incorporate the results of investigations as embodied in the recommendations of referees and committees as these are regularly published promptly in circular form by the Bureau of Chemistry. The detailed proceedings are also published by the same bureau. Reference will be made merely to the nature of the reports and papers which were for the most part submitted in abstract form.

The subject of food adulteration was, as usual, a prominent feature of the programme. Reports of 14 associate referees on this subject were presented. E. F. Ladd made a brief preliminary report on colors, which was supplemented by a paper by H. M. Loomis on the solubility and extraction of colors, and by a paper by A. G. Nicholls on the detection of certain vegetable colors in foods. C. H. Jones, associate referee on saccharine products, reported that the work on this subject during the year had been confined to maple products with particular reference to the malic acid value. Cooperative work by 13 analysts was reported. H. C. Lythgoe presented a report on fruit products. H. E. Barnard reported cooperative work by 10 chemists on the analysis of beer and recommended methods for adoption. C. A. Crampton reported on distilled liquors.

No report was presented on vinegar, but a paper entitled the Fuller's Earth Test for Caramel in Vinegar was submitted by W. L. Dubois. The method is considered unreliable and of value only as a preliminary test. E. M. Chace reported that the work on flavoring extracts had been confined to the proposed methods for the determination of citral in lemon oils and extracts. Results obtained by 4 chemists were included in the report. W. M. Allen, associate referee on baking powder and baking chemicals, reported work on the determination of carbon dioxid. L. M. Tolman, associate referee on fats and oils, reported that much had been accomplished during the year in the cooperative investigations on the cold test. H. C. Lythgoe submitted a brief report on diary products for the associate referee, A. E. Leach. R. E. Doolittle reported on condiments other than spices. This consisted of an outline of methods which the associate referee had found of value in judging the products belonging to this class. C. D. Howard, associate referee on tea and coffee, reported that the work done by him on this subject during the year had been confined principally to a study of methods of determining caffetannic acid. No cooperative work was undertaken. In this connection a review of the methods for chemical analysis of tea was submitted by R. E. Doolittle and F. O. Woodruff. This gave the results of determinations of water extract, tannin, and thein by different methods.

A paper on the determination of moisture in tea by R. E. Doolittle and A. W. Ogden was also read. Drying in an oven was compared with drying in a current of hydrogen. W. L. Dubois, as associate referee on food preservatives, gave the results of his investigations on the determination of salicylic

acid in beer, wine, catsup, and other products. A. McGill, associate referee on cereal products, referred to definitions of grain, flour, etc., and reported a study of the literature on gluten, nongluten, nitrogen, valuation of flours, and gliadin. Investigations on the determination of water in foods were reported by F. C. Webber, associate referee on this subject.

The referee on the determination of nitrogen, J. B. Gibboney, reported considerable cooperative work on the determination of total and available nitrogen by different methods. In connection with this report J. P. Street read a paper on the detection of peat in commercial fertilizers. It was believed that a pentosan determination will indicate the presence of as small an amount of peat as 10 per cent. A report on the separation of nitrogenous bodies in cheese was submitted by the referee, R. Harcourt. The results of cooperative work on the extraction of water-soluble and salt-soluble products were included in the report. F. C. Cook presented a report of investigations on meat proteids.

Dairy products was reported upon by the referee, F. W. Woll, and papers on this subject by G. A. Olson and A. W. Bosworth were read. The latter dealt with the determination of acidity in cheese. J. K. Haywood reported upon feeding stuffs, and C. A. Browne, jr., upon methods of sugar analysis. Considerable work by the referees and collaborators upon sugar was reported. This has been mainly along lines previously studied by the association. The organic constituents of cane molasses were studied, and methods for the determination of nitrogen in molasses were compared. Data were presented showing variations in the polarization of raw cane sugars. The work on the unification of reducing sugar methods was reported by P. H. Walker. Tables for the estimation of dextrose, invert sugar, lactose, and maltose have been prepared and published. W. D. Horne submitted a method for the determination of sulphites in sirups.

A report on medicinal plants and drugs was submitted by the referee, L. F. Kebler. The referee on soils, J. H. Petit, reported cooperative work along the lines approved by the association at the last meeting. The referee on phosphoric acid, B. W. Kilgore, reported that investigations on the determination of available phosphoric acid in basic slag had been conducted, but that the results were not yet ready for publication. The associate referee, J. M. McCandless, reported the results of cooperative investigations on the determination of iron and alumina in phosphate rock and on the neutralization of the official solution of ammonium citrate.

The referee on inorganic plant constituents, W. W. Skinner, reported investigations on the amount of sulphur and phosphorus found in plant ash obtained by various methods. A. L. Knisely, referee on potash, reported cooperative work on the determination of potash in one sample of soil and in one sample of a mixed fertilizer containing considerable organic matter.

The report of the referee on tannin, H. C. Reed, was mainly an argument for discontinuing work by the association along this line. The association, however, voted to continue the work on this subject. A report on insecticides was submitted by the referee, G. E. Colby. This contained the results of preliminary tests of a simple method of determining the kerosene in kerosene emulsions by the centrifugal method.

The committee on food standards, through its chairman, W. Frear, submitted a report of progress. The committee was continued. H. W. Wiley, chairman of the committee on fertilizer legislation, submitted a report on conferences concerning a national fertilizer law. The committee was continued with instructions to secure, if possible, the collaboration of the great fertilizer in-

terests in the perfection of a measure to be submitted to Congress. In this connection a paper on the adulteration of commercial fertilizers was read by J. M. McCandless. Instances of adulteration of fertilizers in Georgia were cited.

A report on the testing of chemical reagents was submitted by the referee, L. F. Kebler. R. J. Davidson submitted a report of the committee on the unification of terms. The association deferred action on this matter for one year, the committee being continued. The committee on definition of plant food, H. W. Wiley, chairman, cited numerous authorities and recommended that plant foods be defined as those substances entering the plant from without and which are utilized in the metabolic activities of the plant. The definition was adopted by the association and the committee discontinued.

One of the special features of the meeting was the report of the committee on revision of methods. The methods of the association are at present embodied in two bulletins of the Bureau of Chemistry and in reports of the proceedings of the annual conventions. The task of revising these for publication in one bulletin has been left to the secretary of the association, aided by a committee on revision. It is expected that this revision of the methods will be published in circular form before the next meeting of the association, when final action can be taken.

The officers elected for the ensuing year are as follows: President, J. P. Street, New Brunswick, N. J.; vice-president, H. Snyder, St. Anthony Park, Minn.; secretary, H. W. Wiley, Washington, D. C.; additional members of executive committee, B. B. Ross, Auburn, Ala., and B. L. Hartwell, Kingston, R. I. The place of meeting for next year was left to the executive committee, preference being expressed for the Jamestown Exposition.

Association of Official Agricultural Chemists of Australasia.—At a meeting held at Sidney, New South Wales, August 20, 1906, and attended by representatives of Queensland, Victoria, New Zealand, and New South Wales, "The Association of Official Agricultural Chemists of Australasia," to consist of "the chief chemists for the departments of agriculture in the states and colonies of Australasia," was formally organized on lines very similar to those of the Association of Official Agricultural Chemists of this country. The objects of the association are stated in its constitution to be: "(1) To secure uniformity in the methods, results, and modes of statement of analyses of fertilizers, soils, feeding stuffs, agricultural products, and other materials connected with this industry. (2) To afford opportunity for the discussion of matters of interest to agricultural chemists."

The meeting took action upon forms of reports on soils for farmers, methods of analysis for soils, fertilizers, feeding stuffs, wheat and flour, dairy products, water, lime, insecticides, and cattle dips. Action on legislation regarding adulteration of fertilizers and other agricultural products and the fixing of standards was postponed, on account of the absence of representatives of some states and provinces, until the next meeting, which is called for March or April, 1907, in Sidney.

A committee was appointed to "investigate means for making short flying [soil] surveys and to test the rapid methods of analysis adopted by the American Bureau of Soils."

"The conference was unanimously of the opinion that all field experimental work should be carried out in conjunction with and under the supervision of the agricultural chemists in so far as relates to design and conduct of the experiments themselves and the interpretation and publication of the results." The extension of such work (*a*) by means of experiments conducted at state farms and agricultural colleges, (*b*) by experiments on the farms of private

individuals, and (*c*) by means of plats in school gardens, was recommended, and the scope and objects of field experiments were outlined. The supplementing of field experiments by pot experiments in the investigation of certain problems was also recommended.

The testing and certification of all calibrated glassware, especially that used in dairies and butter factories, and the allowable limits of error are to be reported upon at the next meeting. Referees were appointed to investigate and report upon the Kjeldahl method with and without the addition of mercury (C. J. Brünnich) and upon the determination of iron and alumina in phosphate rock (B. C. Aston).

The officers elected were F. B. Guthrie, president; C. J. Brünnich, vice-president; W. P. Wilkinson, secretary; B. C. Aston, additional member of executive committee.

Miscellaneous.—The first agricultural high school in Maryland was recently opened at Calvert. As previously announced, the school is under the management of the Cecil County school board, and H. O. Sampson, of this Department, is principal. The school has attracted considerable attention and is reported to be a success.

A new hall and science laboratories, affording accommodations for theoretical and practical work in agriculture, biology, physics, chemistry, and geography, have just been opened by the University College, Reading.

The consul-general of Panama reports that the Republic has contracted with Dr. D. H. Lupi, a well-known Venezuelan agriculturist, to establish a school of agriculture in Panama. Before opening the school Dr. Lupi will travel throughout the Republic and report his agricultural investigations to the government.

The *Industrialist* states that K. C. Davis, principal of the Dunn County School of Agriculture, of Menominee, Wis., has been offered a position as dean of St. Lawrence University, which, as previously announced, was granted an appropriation by the New York legislature for the establishment and maintenance of an agricultural course.

Prof. J. S. Newman, recently connected with Clemson College and the South Carolina Experiment Station, has been granted a pension by the Carnegie Foundation for the Advancement of Teaching.

T. H. Middleton, professor of agriculture in the University of Cambridge, has been appointed assistant secretary to the Board of Agriculture and Fisheries, in succession to Dr. W. Somerville, who has assumed charge of the instruction in agriculture and forestry at Oxford.

James T. Crawley, recently connected with the Hawaiian Sugar Planters' Experiment Station, has been appointed director of the Cuban Station, in succession to F. S. Earle.

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EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, Ph. D., *Assistant Director*.

EDITORIAL DEPARTMENTS.

Meteorology, Soils, and Fertilizers—W. H. BEAL.
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Field Crops—J. I. SCHULTE.
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LIST OF EXPERIMENT STATION AND DEPARTMENT PUBLICATIONS REVIEWED.

NOTE.—The publications of the United States Department of Agriculture, except those of the Weather Bureau, may be purchased from the Superintendent of Documents, Washington, D. C. For the publications of the Weather Bureau requests and remittances should be directed to the Chief of the Bureau. The price of the Record is $1 per volume, or 10 cents per number. The prices of other technical publications are given in the list above. The publications of the State experiment stations are distributed from the stations and not from the Department.

EXPERIMENT STATION RECORD.

Vol. XVIII. January, 1907. No. 5.

Interest in extension work in agriculture is developing rapidly. It is looked to as another means of making the work of the experiment stations more effective by bringing it home to the farmer in a way to appeal to him, and as spreading the influence and aid of the agricultural college. It proceeds upon the basis that the colleges can not give all the instruction in agriculture which is desirable within their walls, but that a vast body of adults outside may be reached and benefited by more direct contact.

Extension work differs from the college work proper in character, aim, and method. The college instruction in both regular and short courses is conducted at a central point at whi h the pupils must be assembled; and the courses are usually definite and fixed, and have a pedagogic form. Extension work seeks the farmer and rural population in their own surroundings, in much the same way that the farmers' institute does; and in a sense it may be regarded as a development and expansion of that form of aid, for in their present status the institutes are a conspicuous form of extension teaching. It must naturally be movable, elementary, and of short duration in any particular locality. It is informational in character rather than educational, for it can only present or demonstrate facts in a general way and in a quite didactic manner, and in the nature of the case can not go far into the reason and theory. While it is in this sense superficial, it is thought possible to give it something of the pedagogic form which is being worked out for other grades of agricultural instruction, by systematizing the various features and presenting them in logical order.

Extension teaching does not take the place of the short courses at the colleges, the elementary agricultural schools, or other agencies at present provided. It supplements the experiment station and the agricultural college, thus constituting a third branch of the system for agricultural instruction, which in its development may be regarded as separate and distinct in field and character, but closely correlated with the other two branches.

Although several kinds of extension work have been carried on for some time, the movement to organize it and give it more definite form as a department of the college is quite new. It is still in the formative stage, and the details of organization are yet to be worked out. The same is true of the scope to be given it, and its relations to certain phases of work which the agricultural colleges and the experiment stations are now doing, and to such agencies as the farmers' institutes.

But there is a widespread demand for more direct contact with the rural population, and a well-defined belief that in the form of extension work this will be the next significant development in the education of the American farmer. No one familiar with the conditions of agriculture in various parts of the country will question the great field of usefulness open to such a department. Soils are suffering and being depleted by lack of proper treatment to conserve their fertility, wasteful methods are pursued in handling irrigation waters and various by-products of the farm, weeds, insects, and plant diseases are allowed to devastate fields, poor seed and inefficient cultivation to greatly reduce quality and yield, and improper selection of cows and other stock to cut down the profit almost or quite to the point of loss. Economists and such men as James J. Hill are crying out against our improvident and reckless agriculture.

The experiment stations have in large measure worked out the remedies for these conditions, and pointed the way to more intelligent and remunerative practice; they have demonstrated these things to the farmers, and have spread the news broadcast through the popular bulletin, the agricultural press, the farmers' institute, and the railroad special. The good they have accomplished in this way is the strongest argument for a wider organization of extension work, for it demonstrates that the farmers can be reached and that a large proportion of them can be led to put the teachings of agricultural science into practice.

But the abilities of the stations in this line are limited by the other demands upon them. In entering upon such work they are stepping out of their field as investigators and delaying development along the lines with which they are especially charged. More and more it is becoming apparent that investigation and extension work in agriculture do not belong together, although mutually dependent and closely associated. The demands upon each are fast assuming such proportions that a separate force is becoming necessary to carry on the more important features of the work. There will be some overlapping for a time, as there will be with the regular educational work of the college, but the interests of all phases of the work are fast calling for greater differentiation.

The extension department seems the next logical step in the devel-

opment of our agricultural system. Those who have given the matter careful study believe that in view of the present feeling toward agricultural experimentation and education, the time is ripe for this step, and they point to indications that we are on the eve of a great extension movement in connection with the agricultural colleges.

The present status of extension work in the United States was brought out in the report of the committee on extension work at the Baton Rouge convention of agricultural colleges and experiment stations. This standing committee was appointed a year ago, at the time of the reorganization of the committees, and was an expression of the necessity and importance of this phase of work.

The committee defined extension teaching in agriculture to embrace "those forms of instruction in subjects having to do with improved methods of agricultural production, and with the general welfare of the rural population, that are offered to people not enrolled as resident pupils in educational institutions." It grouped the various forms of extension work under six headings, as follows: (a) Farmers' institutes; (b) itinerant lectures other than farmers' institutes, including traveling schools of various types, special railroad trains, etc.; (c) literature, including correspondence and reading courses, traveling libraries, etc.; (d) field demonstrations, educational exhibits at fairs, and the like; (e) educational features in charge of rural societies; and (f) formation of leagues or federations of rural societies, establishment of social centers, and similar undertakings. The classification is based primarily upon the kinds of work to be done, and secondarily upon types of institutions doing the work. The first four groups are intended to embrace all forms which belong primarily to universities, colleges, and other agencies whose work is distinctively educational.

In the committee's preliminary survey of extension work inquiries were sent to a wide range of institutions and organizations, agricultural and otherwise, to which a thousand replies were received. These show that there are already established over three hundred active centers of extension teaching in agriculture, and doubtless others for which no reports were received. "Nearly all the agricultural colleges and experiment stations in the land are doing extension teaching to a greater or less degree, and practically all of the granges and thousands of agricultural societies of various sorts do work that could be called extension teaching in agriculture."

Aside from these, it is interesting to note that the normal schools are not only giving courses in agriculture for teachers, but in several instances are sending out lecturers to teachers' and farmers' institutes, giving demonstrations, issuing pamphlets and school bulletins on agricultural subjects, and in other ways putting themselves in

touch with the farmers, teachers, and pupils in the rural communities. State and county superintendents of public instruction reported some form of extension teaching in one hundred and twenty-three cases, representing a great variety of forms; and seventeen State and local libraries reported that they maintain traveling libraries, lectures, lecture bureaus, etc., for agricultural subjects.

Commenting on the enormous amount of extension work which the experiment stations are doing, not only through their printed bulletins and the mass of correspondence of station officials, but also through demonstrations, lectures, and many other lines of effort, the committee asks "Why should the experiment station longer burden itself with extension teaching? Why should it not turn over all of the duties just enumerated to other hands and thus free itself in time, in money, and in energy, for concentration upon the gigantic problems of genuine research?" The obvious answer to this inquiry is the lack of other agencies with the organization and funds to meet the demands for this outside work, and the feeling of responsibility resting on station officers that their work must be adequately placed before the farmers, and that they must serve their interests in various ways. The stations probably feel the pressure for this assistance more keenly than any other agency, unless it be the farmers' institutes, for they are in such close touch with the farmers and their special needs. But there is no question that they would welcome departments equipped for this special object and working in close cooperation with them.

The committee emphasized the desirability of concentrating, coordinating, and systematizing the extension teaching in connection with the land-grant colleges, and of developing the more important aspects of it. It recommended that each college should organize as soon as practicable a department of extension teaching in agriculture, coordinate with other departments or divisions of the agricultural work, with a competent director in charge, and, if possible, with a corps of men at his disposal; and failing this, that it appoint a faculty committee on extension teaching in agriculture, to consider methods and all matters relating to this subject, and especially the feasibility of organizing definitely a department of college extension.

The report points out that "nearly all the institutions are feeling their way. The scattered nature and unorganized character of the work are obvious and significant. Only a few institutions have organized departments of extension teaching. The work thus far has grown out of the needs of the farmers and the desire of the younger institutions to win the regard of the farmers as well as to instruct them." And it adds that these efforts "have been seriously limited by the financial resources at hand and the small amount of time at the disposal of the employees of the institutions."

It is evident that extension teaching has secured a strong foothold in our system of agricultural education. It is felt that the time is not far distant when special appropriations will be made for this department of instruction, and that it is not too soon to begin the consideration of the proper organization of such work to meet the needs of various communities and conditions. Already several States are looking in that direction, and in Iowa a full-fledged extension department has been organized in connection with the agricultural college, manned by a corps of eight persons, which is now conducting itinerant schools with notable success. Eventually this new feature is destined to have a marked effect on the work of the agricultural college, the experiment station, and the farmers' institute, and will do much in enabling them to more effectively and fully realize their true missions.

CONVENTION OF ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS, 1906.

E. W. Allen, Ph. D.,
Office of Experiment Stations.

The twentieth annual convention of this association was held at Baton Rouge, Louisiana, November 14–16, 1906. The headquarters of the association were at the Istrouma Hotel, where most of the sessions were held with the exception of the evening session, at which the presidential address was delivered, which took place in the assembly hall of Louisiana State University. The meeting was an unusually large one, and, as has been the case in recent years, it was made the occasion for the meeting of several societies and associations not affiliated with the association, although related to it in work. Among these were the Associations of State Universities, of Farmers' Institute Workers, and of Horticultural Inspectors, the Society for the Promotion of Agricultural Science, and the Economic Entomologists of the Cotton Belt.

The association enjoyed the hospitality of Louisiana State University and the experiment station, and under their auspices an excursion was made by boat to the Cinclaire sugar plantation and factory, about 8 miles down the Mississippi River, where opportunity was offered to follow the cane from the field through the various stages in the sugar factory, to the separation of the crude sugar. This excursion proved a pleasant social event, and a most interesting experience to a large proportion of the delegates, who were thus given a more definite impression of an important agricultural industry. Following the convention many of the delegates spent a day in New Orleans as the guests of Tulane University, and participated in a banquet given in their honor.

GENERAL SESSIONS.

The general sessions were presided over by President M. H. Buckham, of Vermont, who delivered the annual presidential address on the evening of the first day. This was in the main a plea for placing greater emphasis upon the liberal and "humanistic" culture studies in the curriculum, as a means of preventing narrowness and

crudeness of thought and character. Such training, it was believed, should take the form of instruction in foreign languages, literature, history, economics, philosophy, and especially ethics and religion.

Even though the function of the land-grant colleges is to produce industrial experts, the speaker held that they should graduate liberally educated experts, men who know one subject thoroughly and many fundamentally. "The great problem of the higher education now before us is how to integrate specialism with the totality of which it is a part;" and each college was urged to see that its strongest emphasis is put "upon what in any and every educational institution is its main object and should be its highest ambition and satisfaction and glory—its human output."

The report of the executive committee, presented by Dr. H. C. White, reviewed the events of the year—the passage of the Adams Act, its interpretation, the limitation of the period for which the act makes appropriation, the Comptroller of the Treasury holding that it terminates with the fiscal year 1911, the second session of the graduate school, and the efforts of the committee in behalf of various measures before Congress. Initial steps were taken by the committee for the establishment of a department of rural education in the National Educational Association, but failure of the association to hold a meeting prevented action. The committee was in correspondence during the year with the president of the board of trustees of the Carnegie Foundation for the Advancement of Teaching, with reference to including the land-grant colleges among the beneficiary institutions of the foundation. It was invited to present the matter to the trustees at a meeting to be held November 21, 1906, and Dr. H. C. White was subsequently designated by the committee as its representative in that matter.

The association passed a resolution expressing its gratitude to the executive committee for its painstaking and efficient efforts in connection with the passage of the Adams Act.

The report of the treasurer showed receipts from dues of $1,500, disbursements amounting to $1,537.49, leaving—with the balance carried over from last year—a balance of $958.38. The treasurer also accounted for subscriptions to the fund for the graduate school from 22 institutions for 1905 and 16 for 1906, amounting in all to $950. Of this amount $127.48 was paid for expenses of the committee on graduate study, and $822.52 was turned over to the University of Illinois toward paying the expenses of the school.

The report of the bibliographer, Dr. A. C. True, consisted of a list of books written by agricultural college and experiment station officers. The list included 385 titles of books, the work of 195 men and women now or at one time connected with agricultural

colleges and experiment stations. Books on practically all phases of agriculture and allied sciences were represented in the list, showing the large and creditable contributions of the colleges and stations of this country to the literature of scientific agriculture in its more finished and permanent form.

The executive committee in its report referred feelingly to the death during the year of President G. W. Atherton, foremost among those who organized the association, its first president, and one of its wisest counselors; and of Hon. Henry Cullen Adams, of Wisconsin, "author and achiever of the latest National legislation in benefaction of agricultural research and agricultural progress." The committee had arranged for memorial addresses at the convention, and set apart an hour for their presentation.

The first of these addresses was by Dr. H. P. Armsby, A Memorial of George W. Atherton. The speaker reviewed the salient incidents in Dr. Atherton's varied career, noted his activity in connection with the formation and the work of the association, his efficient services in securing National legislation for the land-grant colleges, and his successful labors for his own institution. The speaker warmly eulogized Dr. Atherton's work and achievements for industrial education, his courageous leadership, indefatigable energy and high ideals, particularly as exemplified in the remarkable development of Pennsylvania State College during the twenty-four years of his presidency.

"Dr. Atherton had the courage and poise of the born leader of men. Never dismayed or disconcerted by opposition or attack, accepting defeat as the stepping stone to future success, with an open mind welcoming every suggestion from others, yet with supreme confidence in his own carefully considered conclusions, he bore his great responsibilities with a quietness and simplicity which were an inspiration to his associates. He was an optimist in the best sense, believing profoundly that right is stronger than wrong and that high and worthy ideals must ultimately triumph, and he showed his faith by his works."

Remarks were made by President James K. Patterson, expressing the esteem in which Dr. Atherton was held by his colleagues in the association, and a resolution of respect to his memory and appreciation of his services presented, which was adopted by the association by a rising vote.

The memorial upon Henry Cullen Adams, read by Prof. W. A. Henry, was an affectionate tribute to the life and services of Mr. Adams as an earnest and able champion of agricultural progress. The paper containing as it did many personal references to the character of the man, and following the progress of the Adams bill

through extracts from his letters to the speaker, was of the greatest interest to members of the convention, who were led to appreciate more keenly than ever Mr. Adams' strength of character, his noble, high-minded purposes, and his deep, intelligent interest in agricultural advancement. "In his going American agriculture lost the truest, wisest friend it ever had in the halls of Congress."

Remarks were made by Dr. White and Dr. True upon Mr. Adams's broadmindedness, his determined interest in promoting the work of the experiment stations, and his unselfish devotion to public service which caused him to die a poor man. There was a very widespread feeling that in the death of Mr. Adams the association and agriculture in general have sustained an unusual loss, and that his place can not be easily filled.

The committee on instruction in agriculture presented a short report through its chairman, Dr. A. C. True. A series of illustrative exercises, covering the general principles of the subject of agronomy, is being published by the Office of Experiment Stations, and will be followed by similar publications covering other branches of agriculture.

The committee has organized subcommittees on secondary courses, on courses in home economics, and on courses in rural engineering. The subcommittee on secondary courses has in preparation a syllabus of a course for use in the regular public high schools, and a series of lessons and practicums showing more fully the character and scope of this course, which it is expected will be published through the Office of Experiment Stations. The subcommittees on courses in rural engineering and on home economics have been engaged in studying the existing status of such courses in the land-grant colleges as a preliminary.

The report of this committee was followed by a lengthy discussion in which the interest of the association in this work was brought out, and its desire for the early publication of the results of the committee's studies, for use in connection with various grades of agricultural instruction. It was followed by the report of the standing committee on graduate study, by Dean L. H. Bailey.

Speaking of the purpose of the school he said: "This graduate work stands for a kind of teaching that lies beyond the college grade and that makes strongly for originality and personality. This enterprise expresses the conviction of the association that agricultural subjects are as capable as any others of advanced study, that they have equal and similar pedagogical value, and that there is need of the pursuit of them. . . . The unqualified success of the second session of the graduate school established the fact that graduate work is in demand. This school is now the only meeting ground for

teachers and investigators in agriculture. The comradeship of it is itself worth the while. . . . The experience with the two sessions of the graduate school indicates that no agricultural college or experiment station can afford not to participate in it if the institution expects to keep in living touch with the knowledge and opinions of the day."

An account was given of the second session of the school, held at the University of Illinois the past summer. (See E. S. R., 17, p. 1129.) The total enrollment was 131 persons, as against 75 persons in the first session. The total expense of holding the session was $3,168.15. Toward this the colleges contributed $950, less $127.48 for traveling expenses of the graduate committee; and the university collected $710 in fees. This leaves a net balance standing against the University of Illinois of $1,635.63 as its contribution to the undertaking.

The committee recommended that the reports of the dean and the registrar of the school, together with other papers relating to it, be published in pamphlet form as a history of the movement. It also recommended that in locating the sessions of the school, the equipment of the institution for postgraduate work should be taken into consideration, that the next school should be located now, and the faculty chosen at once, and that the contributions of $25 from each college toward the support of the school be continued. The committee presented invitations for the graduate school from Iowa State College and from Cornell University, and Dr. W. H. Jordan extended the invitation of the New York State Station in connection with that of Cornell University. The report of the committee was adopted, including the recommendations, and the place of holding the next session of the school was left to the committee.

The report of the committee on extension work was presented by President K. L. Butterfield. This report defined extension teaching in agriculture, and grouped the various forms of extension work under six heads. The main part of the report consisted of a summary of the present status of agricultural extension teaching in this country, on the basis of a circular letter which was widely sent out. The committee recommended that each college establish as soon as practicable a department of extension teaching in agriculture, coordinate with other divisions of the agricultural work and in charge of a competent director, and that pending such action a faculty committee be maintained to study the problem.

Much interest was shown in the report and in its early publication. The association placed itself on record as strongly in favor of adequate appropriations to the Office of Experiment Stations to enable it to enlarge its work upon agricultural education, the details of the

various forms of agricultural extension teaching, and to assist the different institutions to organize this form of work.

An interesting and important report was presented by Dean Davenport for the committee on station organization and policy. This report dealt largely with questions growing out of the Adams Act, and with the personnel of the stations. A summary of the main points covered was given in the previous issue (E. S. R., 18, p. 301).

Mr. L. A. Kalbach, of the Bureau of Education, representing the new commissioner who had been invited to present a paper before the association but was unable to be present, read a paper on The Bureau of Education and the Land-Grant Colleges. The speaker reviewed the relations of the Bureau with the land-grant colleges, and presented statistics showing the increase in attendance at these institutions for the past ten years. In this period the number of agricultural students has increased from 2,712 to 7,418, and the students in mechanic arts from 5,317 to 12,969. The aid granted by the several States has increased from $1,789,235 to $5,768,786. The total income of the colleges for the last year was over $11,500,000. The speaker held that the relation between the Bureau and the colleges was one of cooperation, and expressed himself as favoring its extension.

There was considerable discussion of the establishment of a National university, and of provision for graduate study in Washington. The Association of State Universities had considered the proposition of memorializing Congress to establish a National university at Washington, and appointed a committee to press this measure at the coming session of Congress. Through a committee consisting of Chancellor Andrews and President Fellows it asked the Association of Colleges and Stations to concur in the resolution of the Association of State Universities recommending the establishment of a National university. The discussion made it clear that the university was intended to be an institution for graduate work, taking advantage of the research agencies in the various Departments and Bureaus of the Government. As this matter of graduate study at Washington had received considerable attention from the association in the past, it was felt that it must be brought down to a practical basis before any satisfactory outcome could be expected. The association failed to concur in the resolution, and finally referred the matter to the executive committee to take such action as in its judgment seemed wise, and to make a full report to the association at its next meeting.

An important matter as affecting the policy of agricultural research in this country was embodied in a resolution presented by Dr. Armsby. This resolution called for the appointment, to be made

by the incoming president of the association, of a commission consisting of five persons, two representing the research efforts of the association, one the U. S. Department of Agriculture, and two representing the scientific men not connected with official agricultural investigation, "the duty of which shall be to inquire into and report to this association the organization and policy which, in the opinion of the commission, should prevail in the expenditure of public money provided for scientific experimentation and research in the interests of agriculture, to the end that such funds shall be applied in the most economical, efficient, and worthy manner to the production of results of permanent value."

A very interesting discussion followed this resolution, during which there was brought out a consciousness of the lack of unity of purpose in the research and experimental efforts in this country, the feeling that agricultural science was not taking the definite form it should, and that the research work was not so organized and conducted as to command the respect and recognition of other branches of science which it should receive. There was a feeling that for the purposes of research the various agencies in this country, partly from lack of system, have not been as efficient as they might be made, and that much good might come from an impartial survey of the whole field by men competent to analyze the situation and to plan broadly. This resolution was adopted, but the commission has not yet been announced.

A resolution of President K. L. Butterfield, pointing out the desirability of the association meeting at least once in four years in connection with the National Educational Association, and providing a programme upon the discussion of methods of teaching agriculture and allied subjects, was turned over to the executive committee with instructions to take the matter under consideration.

The association put itself on record as favoring an attempt to secure increased Federal appropriation for education in agriculture and mechanic arts, and instructed its executive committee to cause a measure, drawn on the same general lines as the second Morrill Act, to be introduced into Congress. Such a measure has since been introduced into both branches of Congress.

A resolution presented by President Thach, reciting the brief time which the stations had to dispose of the first appropriation under the Adams Act, and requesting the executive committee to "secure such remedy as may seem practical," was adopted.

The officers elected for the ensuing year are as follows: President, L. H. Bailey, of New York; vice-presidents, T. D. Boyd of Louisiana, M. A. Scovell of Kentucky, B. C. Buffum of Wyoming, R. W. Stimson of Connecticut, and C. G. Hopkins of Illinois; secretary and

treasurer, J. L. Hills, of Vermont; bibliographer, A. C. True, of this Office; executive committee, H. C. White of Georgia, J. L. Snyder of Michigan, W. H. Jordan of New York, C. F. Curtiss of Iowa, and W. E. Stone of Indiana.

In the section on college work and administration, E. A. Bryan, of Washington, was chosen chairman, and H. C. Price, of Ohio, secretary. M. A. Scovell was elected chairman of the section on experiment station work, and C. E. Thorne, of Ohio, secretary. H. J. Waters, of Missouri, and H. T. French, of Idaho, together with the secretary of the section, were made the programme committee.

The members of the standing committees whose terms expired this year were all reappointed for the period of three years.

SECTION ON COLLEGE WORK AND ADMINISTRATION.

This section considered three main topics, each subdivided under a number of heads: (1) Administration of the land-grant colleges—organization and classification of the instructional force, control of student activities and student labor. (2) Relation of the land-grant college to the public school system, to the agricultural industries, and to the mechanical industries. (3) Curriculum of the land-grant college—study of home economics in the land-grant college, the short practical course, its place and importance, and agricultural extension.

There was no stenographic report of the proceedings of this section and few formal papers were read, the speakers assigned to the different topics speaking extemporaneously for the most part. It is not possible, therefore, to give an account of the meetings of the section.

SECTION ON EXPERIMENT STATION WORK.

This section occupied itself principally with questions relating to the Adams Act and agricultural research in general. The first session was devoted to a general discussion of The Kind and Character of Work under the Adams Act. Dr. A. C. True explained the provisions and limitations of the Act, the plans for the administration of the funds under it, and some of the difficulties experienced by the stations in inaugurating their new work.

Dr. H. P. Armsby urged that the stations should in a measure cut loose from the consideration of the legal aspects, and recognize not the necessity, but the opportunity under this Act. He pointed out that a great deal of our investigation heretofore has been directed to ascertaining certain facts, and he suggested that it might be well to make a distinction between experiments directed to ascertaining facts, and experiments directed to answering the questions how or why—that is, to correlating facts and establishing principles. He laid down the proposition that "original research is research directed to the establishment of the underlying principles of agriculture."

There was quite general recognition of the fact that a large proportion of our station work has been, from the necessities of the case, superficial, and that it has not gone sufficiently deep to establish fundamental principles. It was urged that there will necessarily result something of a differentiation among workers and among stations, and also a sharper line between teaching and investigation. In illustration of this, the work upon animal nutrition, carried on at the Pennsylvania Station with the respiration calorimeter, was cited as an instance of special fitness in the way of a leader and equipment which few stations could expect to attain. The results of such fundamental investigations are applicable to the country at large, and are of special interest and value to the experiment stations in connection with their feeding work. In recognition of this the section expressed its commendation of this work, and its hope that it would be continued and developed to the fullest extent deemed practicable by the board of control.

One of the difficulties recognized in the undertaking of research work was the lack of men suited to such work, for it was clearly shown that the main reliance must in the end be placed upon the men, and if they have not the proper conception of research and the spirit for it the work will not be of high order. Another difficulty frequently mentioned was the demand for practical results and the lack of interest by the general public in researches into fundamental principles. These things, however, will gradually right themselves as the work progresses, for it will attract men of proper training to it, and its practical value will become more broadly apparent.

The section passed a resolution recording its approval of the methods adopted by the Office of Experiment Stations for the administration of the Adams Act.

Three papers were presented before this section—one on Problems of Animal Nutrition, by Dr. H. P. Armsby; another on Methods of Experimentation in Feeding for Meat Production, by H. W. Mumford; and the third on Methods of Experimentation in Feeding for Milk Production, by J. L. Hills.

Dr. Armsby's paper was an able and scholarly review of the feeding work thus far carried on by the stations, its limitations, and the kind of investigation needed at the present stage of knowledge. Without underestimating the great value of much of the work done by the stations, the speaker believed it had "served only to a very subordinate degree to reveal principles. The latter we have seemed largely content to borrow from foreign investigators." He called attention to the limitations of digestion experiments and of the ordinary feeding experiments, pointing out the difference in efficiency of digestible matter of different feeding stuffs, as shown by the work of

Zuntz, Kellner, and himself. "We stand in urgent need," he said, "of actual determinations by modern methods of the nutritive value of feeding stuffs for different purposes, the results of which we may substitute for the assumptions on which we are now basing our teachings."

Among the subjects for investigation mentioned were studies upon the difference in the value of feeds for maintenance and for production, studies of the physiological value of individual chemical ingredients, the influence of aromatic and flavoring substances in feeding stuffs, variations in individual requirements of food for production, the protein requirement, and the influence of food upon the quality of the product. But in addition to these more scientific studies, the speaker emphasized the importance of the practical feeding experiment, remarking that "the more thorough and exhaustive our scientific studies of nutrition become, the greater will be our need for correlated practical experiments, scientifically planned, to answer definite questions regarding the application in practice of the principles worked out in the laboratory or the respiration apparatus."

This article was so suggestive of the needs of animal nutrition that it is hoped to publish it in full in a subsequent issue of this journal.

In the discussion of the paper Dr. Jordan called attention to the effect of certain mineral ingredients of the food upon digestion, and the reaction of certain food constituents upon the animal, as illustrations of a class of investigations which do not require expensive apparatus.

Professor Mumford's paper dealt with the essentials of practical experiments in feeding for meat production, precautions to be observed, and factors which influence the results and conclusions. The subject was treated under the head of the investigator and his point of view, the nature of the investigation, plan, execution, interpretation, and presentation.

Director Hills, in his paper on Methods of Experimentation in Feeding for Milk Production, divided his subject into the scheme, the animals, and their environment. He favored the alternation plan of testing rations, discussed the length of period, number of cows, period of lactation, and the extent of the experimental error, upon which the Vermont Station has been working for several years.

The report of the committee on unification of terms used in expressing analytical results, read by Dr. C. G. Hopkins, recommended the adoption as rapidly as possible of the element system of reporting results in case of fertilizers, soils, etc., and such changes in fertilizer laws as this would require. It suggested ten years as the period for making this gradual change from the present system. It

also recommended stating the composition of fertilizers in terms of "available" and "inert" nitrogen, phosphorus, and potassium, using these terms in the sense recognized by the Association of Official Agricultural Chemists; and, finally, that the source of the various fertilizing elements be required to be stated as a part of the guaranty.

These recommendations were conditioned on securing the concurrence of the American Chemical Society and the Association of Official Agricultural Chemists. The latter association considered a similar report at its recent meeting and decided to defer action one year. After considerable discussion, the report was adopted by the section, carrying with it the approval of the recommendations, and the committee was continued with instructions to seek to bring about international action.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

The rapid determination of phosphoric acid by weighing the ammonium phosphomolybdate, J. Graftiau (*Bul. Assoc. Chim. Sucr. et Distill., 24 (1906), No. 3, pp. 315–320*).—In the method described acid solutions of phosphates and phosphatic slag, corresponding to 0.2 gm. of material in case of ordinary superphosphates, mineral phosphates, and phosphatic slags, 0.1 gm. in case of rich phosphates and superphosphates, and 0.4 gm. in case of mixed fertilizers, are neutralized with ammonia to the point of precipitation, the precipitate carefully redissolved by nitric acid, and 10 cc. of Petermann's ammonium citrate added.

The procedure is then the same as with citric acid solutions, the treatment of which is as follows: Using the same amounts of material as in case of acid solution add 2 to 3 cc. of concentrated nitric acid, 10 to 15 cc. of saturated ammonium nitrate solution, 50 to 70 cc. of water, bring to the boiling point, remove the flame, and add 60 to 100 cc. of ammonium nitromolybdate. Allow to stand 15 to 30 minutes at about 70° C., remove supernatant liquor by means of a siphon, collect the precipitate on a small tared filter, and wash carefully with 1 per cent nitric acid. Dry for 2 hours at 105 to 110° C., and weigh.

Comparisons of this method with the citro-mechanical method showed somewhat higher results by the rapid method in case of superphosphates and phosphatic slag, but irregular variations in the case of mixed fertilizers.

Contribution to the titration of phosphoric acid, L. Schucht (*Ztschr. Angew. Chem., 19 (1906), No. 41, 1708–1711; abst. in Chem. Centbl., 1906, II, No. 20, p. 1582*).—This article discusses the influence of concentration, associated salts (particularly the addition of sodium chlorid), etc., on the results of titration of phosphoric acid and superphosphate solutions with sodium hydroxid and by the oxalate method.

A contribution to the determination of lime and magnesia, F. Westhausser (*Ztschr. Angew. Chem., 19 (1906), No. 40, pp. 1682, 1683; Chem. Ztg., 30 (1906), No. 80, p. 985*).—This is a note on an article presented at the recent meeting of the German Association of Naturalists and Physicians, which discusses the application in analytical methods of the fact that when water solutions of magnesium chlorid are evaporated to dryness and heated a basic salt is formed which is very difficultly soluble in water, calcium chlorid under the same treatment remaining readily soluble in water.

Description of a calcimeter, N. Passerini (*Staz. Sper. Agr. Ital., 39 (1906), No. 1–2, pp. 28–32, fig. 1; abs. in Chem. Centbl., 1906, II, No. 12, p. 1019, fig. 1*).—A simple apparatus for determining lime in soils by means of carbon dioxid evolved on treatment with acid is described.

Chemical soil analysis, E. A. Mitscherlich (*Fühling's Landw. Ztg., 55 (1906), No. 11, pp. 361–373*).—A general discussion of this subject, being in a sense a preliminary notice of the author's treatise on soils, in which methods

of determining the available plant food of soil based on (1) solubility in water, and (2) solubility in water charged with carbon dioxid are fully described and advocated.

On the analysis of nitrate of soda, P. BECK (*Ztschr. Analyt. Chem., 45 (1906), No. 11, pp. 669–687*).—A series of determinations on pure sodium nitrate and on samples of commercial nitrate is reported, which show that the indirect method in common commercial use is inaccurate and should be replaced by direct methods of analysis.

Scheibler's apparatus for the determination of carbonic acid in carbonates; an improved construction and use for accurate analysis, S. H. COLLINS (*Jour. Soc. Chem. Indus., 25 (1906), No. 11, pp. 518–522, figs. 3; abs. in Bul. Soc. Chim. Paris, 3. ser. (1906), No. 18–19, p. 1069*).—Studies of the causes of error in the use of this apparatus are reported and a modification which is believed to secure greater accuracy is described in detail.

Determination of ash in an electrically heated furnace for elementary analysis, H. SEIBERT (*Chem. Ztg., 30 (1906), No. 79, pp. 965, 966*).—Referring to a recent article by von Konek (E. S. R., 18, p. 109), the author reports comparative determinations which show that with proper precautions this method of determining ash does not give higher results than the ordinary methods used. He attributes the higher results obtained by von Konek to occlusion of oxygen by the platinum vessel in which the incineration takes place in the furnace.

Report of committee on standard methods of water analysis to the laboratory section of the American Public Health Association (*Chicago, 1905, pp. 141*).—This is a reprint in pamphlet form of an article which has already been noted (E. S. R., 17, p. 334).

The determination of total arsenic acid in London purple, E. G. MAHIN (*Jour. Amer. Chem. Soc., 28 (1906), No. 11, pp. 1598–1601*).—The coloring matter is removed from the acid solution by means of chlorin gas. Several slight modifications are made in the methods of the Association of Official Agricultural Chemists for reducing the arsenic acid to arsenious acid.

A direct method for the analysis of milk, E. D'HUART (*Inst. Luxemb., Sect. Sci. Nat. [etc.], Arch. Trimset., 1906, Nos. 1–2, pp. 125–133, figs. 2*).—Instead of sand or other absorbent material the author uses a roll of fine platinum wire gauze sufficient to absorb from 8 to 10 gm. of milk. The gauze containing the milk may be weighed in a covered crucible or in a weighing bottle. After drying to a constant weight and determining the total solids the fat is extracted in a Soxhlet apparatus and the ash subsequently determined on the same sample. Analyses made by this method in comparison with other methods are reported.

Experiments in relation to milk testing, H. HÖFT (*Milchw. Zentbl., 2 (1906), No. 8, pp. 355–360*).—The changes in the total solids of buttermilk upon long keeping were found to be slight. During the first four days the decrease averaged about 0.16 per cent and during 6 or 7 days 0.33 per cent. After that the reduction was very slight.

The addition of ammonia to acid or curdled milk exerted no appreciable influence upon the determination of total solids. Ammonia was added to skim milk, buttermilk, and whole milk, and total solids were determined at intervals for about 3 months. The loss in total solids was small, the greatest amount during a period of 3 weeks being 0.17 per cent.

On the estimation of proteid in human milk, A. W. SIKES (*Jour. Physiol., 34 (1906), No. 6, pp. 481–489*).—The results and conclusions of the author's investigations are stated as follows: (1) Precipitation of the proteid of human milk by means of hot alcohol is complete; (2) the hot alcohol extracts the nonproteid constituents completely; (3) the addition of a small quantity of citric acid prevents the precipitation of the salts; (4) the proteid is weighed directly,

not calculated from the amount of the nitrogen it contains; (5) by centrifuging the method is rendered more rapid than by filtering, and the washing of the precipitate is more thorough; and (6) drying of the precipitate is rapid.

A simple method for the quantitative determination of proteids in milk, T. R. Boggs (*Bul. Johns Hopkins Hosp., 17 (1906), No. 187, pp. 342, 343*).—The proteids in milk diluted in the proportion of 1 : 10 are precipitated in an Esbach tube by means of a 10 per cent solution of phosphotungstic acid in about 3 per cent hydrochloric acid. The reading of the precipitate is made after 24 hours.

The rapid determination of water in butter, G. E. Patrick (*Jour. Amer. Chem. Soc., 28 (1906), No. 11, pp. 1611–1616*).—The author expels the water from 12 to 16 gm. of butter by boiling in a wide test tube over a naked flame. The water content as indicated by the loss in weight by this method is believed to be seldom if ever more than 0.3 per cent from the truth.

Direct determination of water in butter and other fats, C. Aschmann and J. P. Arend (*Chem. Ztg., 30 (1906), No. 78, p. 953, fig. 1*).—This is based upon the distillation of the fat with xylol and the measuring of the water.

The refraction of nonvolatile fatty acids of butter, W. Ludwig and H. Haupt (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 9, pp. 521–523*).—This is considered of value in determining the adulteration of butter with 10 per cent or more of cocoanut oil. Butter from various sources showed refractometer numbers of the nonvolatile fatty acids varying from 29 to 30.2 and palmin from 16.1 to 16.5, while the addition of 5 per cent of palmin to butter reduced the refractometer number of the nonvolatile fatty acids to 28, the addition of 10 per cent to 26.9, the addition of 50 per cent to 22, and the addition of 90 per cent to 17.1.

On the detection of the adulteration of butter with cocoanut oil and oleomargarin, L. Robin (*Compt. Rend. Acad. Sci. [Paris], 143 (1906), No. 15, pp. 512–514*).—The fatty acids in cocoanut oil are almost entirely soluble in 60 per cent alcohol at a temperature of 15° C., those of butter only partially soluble, and those of margarin only slightly soluble. In water the fatty acids in butter are much more soluble than those of cocoanut oil and margarin.

These characteristics are believed to be sufficient to enable the determination of mixtures of cocoanut oil and margarin with butter, and a method of procedure for this purpose is outlined.

On the detection of formaldehyde in milk, S. F. Acree (*Jour. Biol. Chem., 2 (1906), No. 1–2, pp. 145–148*).—According to the author's investigations Hehner's test for formaldehyde in milk depends upon the presence of casein and lactalbumin, and the intensity of the color bears a relationship to the amount of these substances present. Of several aldehydes tested (acetaldehyde, paraldehyde, chloral hydrate, benzaldehyde, cuminol, and vanillin) vanillin alone gave the same reaction as formaldehyde. Other complex proteids as well as casein and lactalbumin gave the violet color with formaldehyde and sulphuric acid. The globulin from squash seed was found to give the most intense color and this substance was made use of in detecting formaldehyde in milk in concentrations less than 1 to 250,000. A method for this purpose is suggested.

Determination of salicylic acid in canned tomatoes, catsups, etc., W. L. Dubois (*Jour. Amer. Chem. Soc., 28 (1906), No. 11, pp. 1616–1619*).—By the method suggested the color is removed before extraction with ether. The material is rendered alkaline with ammonia and then treated with milk of lime. In the filtrate from this mixture the salicylic acid is determined colorimetrically.

Boric acid: Its detection and determination in large or small amounts, W. H. Low (*Jour. Amer. Chem. Soc., 28 (1906), No. 7, pp. 807–823, figs. 2*).—

Modifications are suggested of the qualitative test with turmeric paper and of the quantitative test, which depends upon the ignition of the sample, distilling with methyl alcohol, and detection with indicators, the methods and apparatus being described in detail.

Attention is called to the wide distribution of boric acid normally in food products. "Boric acid occurs naturally in apples and probably in other fruits and vegetables. It is present in almost all common salt and some kinds contain relatively considerable amounts of it." Determinations of boric acid in a number of kinds of salt used in packing-house products showed the presence of 0.0435 to 0.76 grain per pound avoirdupois.

The fermentation of cane molasses, and its bearing on the estimation of the sugars present, G. HARKER (*Jour. Soc. Chem. Indus., 25 (1906), No. 17, pp. 831, 833–836*).—The alcohol actually produced from the fermentation of cane molasses is generally much less than the possible yield as calculated from the determinations of saccharose and reducing sugars.

The author concludes from his investigations that this is due to the fact that the analytical figures overstate the amount of fermentable sugars actually present. A considerable portion of what analysis indicates as saccharose is not inverted by invertase and hence is not that substance. From the figures obtained in some of the experiments, the author found it possible to apply a correction to the ordinary analysis. Calling the possible yield of alcohol from a molasses 100, the corrected analysis indicated a yield of 85.8. It was found that the bodies which appear as saccharose in the analysis and which are inverted by acids but not by invertase are decomposed during the early stages of fermentation.

On various methods of determining total solids in wine, F. RONCALI (*Staz. Sper. Agr. Ital., 39 (1906), No. 4, pp. 289–322*).—Direct and indirect methods of determining total solids in wine were compared on numerous samples from various sources.

A study of the methods for the determination of esters, aldehydes, and furfural in whisky, L. M. TOMAN and T. C. TRESCOT (*Jour. Amer. Chem. Soc., 28 (1906), No. 11, pp. 1619–1630*).

A method for the determination of lead number in maple sirup and maple sugar, A. L. WINTON and J. L. KREIDER (*Jour. Amer. Chem. Soc., 28 (1906), No. 9, pp. 1204–1209*).—The method proposed depends upon the use of a definite volume of standard lead subacetate solution and upon the determination of the lead remaining in this solution after it has been used as a precipitating reagent with a sample of maple sugar or sirup.

"The determination of ash and its characters and of lead number will usually suffice for the detection of the adulterants now in common use."

A new method of determining glycogen, E. PFLÜGER (*Arch. Physiol. [Pflüger], 114 (1906), No. 5–6, pp. 231–247*).—The author discusses recent literature on glycogen determination and proposes some modification and amplification of his method of determining it.

Text-book of physiological chemistry, E. ABDERHALDEN (*Lehrbuch der physiologischen Chemie in Dreissig Vorlesungen. Berlin and Vienna: Urban & Schwarzenberg, 1906, pp. VIII + 787, figs. 3*).—In preparing this text-book the author states that he has selected those subjects of physiological chemistry which admit of reasonably complete treatment. The book includes 30 lectures, 4 of which are devoted to carbohydrates, 6 to proteids, 1 to nucleoproteids and other cleavage products, 2 to ash constituents, and 2 to metabolism.

This volume as a whole constitutes a summary of available information regarding the theories of nutrition and the views which are at present held regarding the chemical processes which take place in the body. The author

states that he has purposely omitted references to discussions of laboratory methods. Throughout the volume numerous references are made to the literature of the subjects treated, and indexes are provided.

Proceedings of the fifth annual meeting of the Association of German Food Chemists (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 1-2, pp. 1-144*).—This meeting was held at Nürnberg, May 25, 26, 1906.

Papers on the following subjects were presented and discussed: Food control and its difficulties, by J. König; spices, by E. Spaeth; fruit juices and jellies, by W. Fresenius; the examination and judging of carbonated lemonade, by A. Beythien; the use of saponin in carbonated beverages, by E. Schaer; judging the purity of water, by H. Grosse-Bohle; the glazing of coffee, by E. Schaer; cocoa and chocolate, by H. Beckurts; contribution to the knowledge of cocoa, by H. Matthes and F. Müller; the influence of cocoa on the organism, by R. O. Neumann; the solanin content of potatoes, by M. Wintgen; judging wine and wine legislation, by W. Fresenius; poisoning with phosphoreted hydrogen, by P. Lehnkering; and chemical investigations of Mosel wine, by W. I. Baragiola.

Report of the chemical section of the Wellcome research laboratories, Gordon College, Khartoum, W. Beam (*Khartoum: Dept. Ed., Sudan Govt., 1906, pp. 205-244, figs. 15*).—Included in this report are analyses of Nile River water; the milk supply of Khartoum; several commercial dried milks; Sudan grains, including wheat, corn, sorghum, millet, lentils, *Vigna sinensis*, and *Dolichos lablab*; salt; limestone; gums; and other products. Notes are given on the determination of viscosity of gum solutions, the use of asbestos as a funeral shroud, on a new form of hydrometer, on the determination of crude fiber, and on a simple form of blast lamp for use with benzine. The hydrometer consists of the ordinary form provided with a float made of a hollow ring of glass, supporting an upright short section of amber colored glass tubing, at the top of which rather than at the surface of the liquid the reading is taken.

Annual report on the progress in agricultural chemistry, 1905, T. Dietrich et al. (*Jahresber. Agr. Chem., 3. ser., 8 (1905), pp. XXXVI + 561*).—This contains the usual abstracts of important articles on agricultural chemistry appearing during the year with titles of articles of less importance.

Drug legislation in the United States, L. F. Kebler and E. T. Ragan (*U. S. Dept. Agr., Bur. Chem. Bul. 98, pp. 217*).—This is a compilation of all the National and State laws in force governing the sale of drugs.

METEOROLOGY WATER.

The classification of climates, R. DeC. Ward (*Bul. Amer. Geogr. Soc., 38 (1906), Nos. 7, pp. 401-412, figs. 3; 8, pp. 465-477, pls. 2, figs. 7*).—"It is the object of this article to give a brief summary of the general climatic types which result from the control of land and water, and of altitude over the more important elements of climate." The author describes particularly Supan's climatic provinces, the classifications of Köppen and Hult, and Ravenstein's hygrothermal types.

He concludes that the broad classification of climates as marine, continental, and mountain, with the subdivisions of desert, littoral, and monsoon is convenient for purposes of indicating the interaction of climatic elements under the control of land, water, and altitude, but for detailed study some scheme of classification in which similar climates in different parts of the world are grouped together and geographic distribution receives particular attention is needed.

Supan's classification is considered rational, simple, and satisfactory; Köppen's botanical classification is of value, but particularly for students of plant geography rather than of general climatology. It is stated that this "classification has the great merit of recognizing the existing differences of climate between east and west coasts, and between coasts and interiors. The coordination of districts of vegetation and of climate, which this scheme so strikingly emphasizes, is a noteworthy fact in climatology." Hult's classification is not considered to have any advantages over that of Supan. Ravenstein's hygrothermal types are said to rest upon unsatisfactory data.

Changes of climate, R. DeC. Ward (*Pop. Sci. Mo., 69 (1906), No. 5, pp. 458–470*).—A general discussion of this subject in which the conclusion is reached that there is no sufficient warrant for believing in considerable permanent changes of climate over large areas. An eleven-year period of change has been made out, of more or less certainty for some of the meteorological elements, and a thirty-five-year period has been somewhat more positively determined, but as yet it has not been possible to make practical use of these periodic changes in forecasting.

"It was formerly believed that climate changes locally, but progressively and permanently. It is now believed that oscillations of climate are limited in time, but occur over wide areas. Finally, it is clear that man, whether by reforestation or deforestation, by flooding a desert or by draining a swamp, can produce no important or extended modifications of natural climate, which is governed by factors beyond human control."

Climate [of Alaska], C. Abbe, Jr. (*U. S. Geol. Survey, Prof. Papers No. 45, pp. 133–200, pl. 1, map 1*).—This is a section of a monograph on the geography and geology of Alaska, summarizing the available records of temperature, precipitation, and casual phenomena which have been published since the appearance of Dall and Baker's work in 1879. The climatology of Alaska as a whole and of different districts of the Territory is discussed.

The work of the Weather Bureau and its relation to transportation, E. H. Bowie (*Sci. Amer. Sup., 62 (1906), No. 1611, pp. 2518, 2519*).—This is a paper read before the St. Louis Railway Club, which discusses briefly the nature and value of the predictions of the Weather Bureau in relation to transportation.

The public weather service of the German Empire, Grohmann (*Fühling's Landw. Ztg., 55 (1906), No. 18, pp. 612–616*).—This article discusses briefly the uniform weather service which was established for the whole German Empire June 15, 1906, and which has 14 forecasting centers, namely, Königsberg, Bromberg, Breslau, Berlin, Dresden, Magdeburg, Ilmenau, Weilburg, Hamburg, Munich, Stuttgart, Karlsruhe, Strassburg, and Aix-la-Chapelle.

Special attention is given to the weather maps and the general conclusion is reached that a wider dissemination of meteorological information is necessary to the understanding and use of these maps.

Meteorological observations at Storrs, and general weather and crop review, W. A. Stocking, Jr. (*Connecticut Storrs Sta. Rpt. 1905, pp. 215–222*).—This is a record of observations on temperature and precipitation during each month of 1904 at Storrs; rainfall during the six months ended October 31, 1904, at 20 places in Connecticut; summary of rainfall for the six months ended October 31 for 20 places in Connecticut during the 15 years 1889–1903; monthly mean temperature and monthly precipitation for 16 years (1888–1903); and dates of last and first killing frosts for 16 years. The total percipitation for the year at Storrs was 40.19 in., 7.24 in. less than the average for the past 16 years. The principal deficiency in rainfall occurred in May, July, and November. The mean temperature for the year was 44.8°, 2.2° lower than the average for the

past 16 years. Deficiencies in precipitation and rainfall were quite general throughout the State. At Storrs the last killing frost in the spring occurred April 24 and the first in the fall, September 22, giving a growing season of 150 days free from frost.

Meteorological observations, J. E. Ostrander, R. C. Lindblad, and T. A. Barry (*Massachusetts Sta. Met. Buls. 213, 214, pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during September and October, 1906. The data are briefly discussed in a general note on the weather of each month.

[Meteorological summary for 1904–5], E. Burke (*Montana Sta. Rpt. 1905, pp. 279, 280*).—The usual summary of observations on temperature, precipitation, cloudiness, etc., is given.

Report on meteorological observations during the year 1905 (*Overzicht der Meteorologische Waarnemingen, gedaan in den Cultuurtuin te Paramaribo, in het Jaar 1905. [1906], pp. 16*).—Summaries of tridaily observations at Paramaribo on atmospheric pressure, temperature, humidity, direction of wind, cloudiness, and precipitation are given.

Antigua meteorological returns, 1905 (*West Indian Bul., 7 (1906), No. 3, pp. 250–263*).—Data are given for average rainfall in Antigua from 1874 to 1905, inclusive, monthly rainfall at a large number of places in the island during the year 1905, and monthly temperature, pressure, dew point, and wind movement at the government laboratory, St. Johns, during 1905.

Notes are also given on a cyclonic disturbance which occurred north of Antigua August 31 and September 1, 1906, with a discussion of the rainfall of St. Croix in relation to sugar crops. The general conclusions arrived at in the latter case are that a small amount of rain evenly distributed gives better results than larger rains falling unevenly. The rainfall of July, August, and September decides the crop of the next year whenever the canes are in a healthy condition at the end of June. Rain falling in January to March of the year the crop is taken off seems to have no influence.

British rainfall, 1905, H. R. Mill (*London: Edward Stanford, 1906, pp. 88+271, pls. 7, figs. 11; rev. in Nature [London], 75 (1906), No. 1931, p. 5*).—This, the forty-fifth annual report on British rainfall, is compiled from observations by 4,096 volunteer observers in different parts of the British Isles. The distribution of the rainfall both in space and time is discussed as well as the relation of total rainfall during the year to the normal.

Original articles of special interest are a review of Hellmann's report on precipitation in the North German river basins, and a study of the relation of evaporation from a water surface to other meteorological phenomena, namely, temperature of air and soil, duration of sunshine and rainfall, relative humidity, and amount of rain at Camden Square.

The report shows in general that 1905 was exceptionally dry, the rainfall deficiencies for the year being for England and Wales 16 per cent, for Scotland 5 per cent, for Ireland 12 per cent, and for the British Isles as a whole 12 per cent. The average rainfall during the year was 28.8 in. for England and Wales, 43.04 in. for Scotland, 35.8 in. for Ireland, and 33.92 in. for the British Isles.

The observations on evaporation as related to other meteorological phenomena were made at Camden Square by means of a standard iron tank 6 ft. square and 2 ft. deep, the rim of the tank rising 3 in. above the surface of the grass-covered ground and the surface of the water being maintained nearly at the ground level. Measurements were made by means of a hook-gage resting on the rim of the tank and read by means of a vernier to the hundredth of an inch. The

results show that "when the rate of evaporation was below the average for the year, it followed the mean temperature; when it was above the average for the year it followed the sunshine and the black-bulb temperature, and that the wind appeared to have had but little effect upon it." The rainfall during the year at Camden Square was 22.97 in., the evaporation 16.14 in.

The mean of the records of evaporation at 11 different stations shows that the amount of evaporation increased steadily to July and then fell uniformly until the end of the year.

The rains of the Nile Basin in 1905, H. G. LYONS (*Cairo: Al-Mokattam Printing Office, 1906, pp. 40, pls. 9*).—This report includes tables and maps of monthly rainfall and data and diagrams of Lake Victoria levels, of Nile floods, and of gage readings for Lake Albert, Bahr el Ghazal, White Nile, Blue Nile, Atbara, and Nile.

The physiography of the River Nile and its basin, H. G. LYONS (*Cairo: National Printing Dept., 1906, pp. VIII+411, pls. 48, map 1*).—This monograph deals in an exhaustive manner with the dimensions, geology, climate (particularly rainfall and winds), and water régime (floods, river flow, lake levels, etc.) of the different parts of the Nile Valley. A bibliography of 216 references is given.

Hail, LOISEL (*Abs. in Rev. Gén. Agron., n. ser., 1 (1906), No. 6–7, pp. 250–254*).—This is a review of an article discussing the nature and origin of hail and the damage caused by hailstorms.

It is stated as a result of a number of observations that ordinary hailstones weigh from 4 to 5 gm., although some have been observed which weigh 600 gm., and a few which exceed 1 kg. in weight. Hailstorms are said to be most frequent in the spring and summer, June and July being the months of maximum frequency. They are associated with storm conditions in which electric phenomena are most evident, and it is believed electrical activity plays an important part in the formation of hail. It is stated that hail is formed at high elevations, probably at the summits of the cumulo nimbus storm clouds, which are usually from 4,000 to 5,000 meters high. Hailstorms are usually of very short duration, not exceeding, in the author's observations, 5, 10, or at most, 15 minutes. Contrary to the general belief it is claimed that the distribution of hailstorms is not affected by topography. Data are given showing the enormous loss from hail in France.

On hail and weather shooting, R. BAUR (*Ztschr. Angew. Chem., 19 (1906), No. 40, p. 1678*).—This is a note on a discussion at the recent meeting of the German Association of Naturalists and Physicians on the relative efficiency of different kinds of ordnance for this purpose.

The mechanics of water softening, J. J. ROYLE (*Jour. Soc. Chem. Indus., 25 (1906), No. 10, pp. 452–456, figs. 4; abs. in Bul. Soc. Chim. Paris, 3. ser., 36 (1906), No. 18–19, p. 1068*).—Apparatus for use in the lime-soda process of water softening is described.

Underground waters of Tennessee and Kentucky west of Tennessee River and of an adjacent area in Illinois, L. C. GLENN (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 164, pp. 173, pls. 7, figs. 13*).—This report is based upon the results of a part of the summer's field work and of subsequent trips over various portions of the area dealt with, as well as upon correspondence with owners of wells and springs and well drillers.

The report deals with "an area in western Tennessee and Kentucky and southern Illinois in which the surface formations are for the most part unconsolidated deposits that were laid down in an embayment of the great sea that once existed in the Mississippi Valley. In Tennessee this embayment area in-

cludes the portion of the State between Mississippi and Tennessee rivers with the exception of a narrow strip along the west bank of Tennessee River. In Kentucky it includes all of the State west of Tennessee River with the exception of a narrow strip that extends along the west bank almost to Paducah. In Illinois it includes a large part of Massac, Pulaski, and Alexander counties."

The main topics discussed in the report are source of underground water, artesian conditions, physical features of region, geology, underground-water resources, mineral waters of western Kentucky, and methods and cost of well drilling.

A bibliography of 50 references to the most important articles on the geology and hydrography of the region described is given.

The effect of copper upon water bacteria, K. F. Kellerman and T. D. Beckwith (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 100, pt. 7, pp. 19*).—The results of a study of the resistance of several species of bacteria commonly occurring in Potomac River water to copper sulphate solutions of various strengths are reported, as well as of the effect of carbon dioxid on the viability of *Bacillus coli* and *B. typhi*, and of the relation of copper sulphate treatment of water to filtration.

In the first case the results indicate "clearly that no danger to most of the common saprophytic bacteria can be expected from using concentrations of copper sufficiently strong to destroy *B. coli*."

It was found that the presence of carbon dioxid materially increased the resistance of *B. coli* and *B. typhi* in tap water and in triple-distilled water alone and with the addition of calcium carbonate.

Experiments on the use of copper sulphate in connection with filtration showed "that in mechanical filtration with alum it is necessary to limit the use of copper sulphate to treatment some hours before coagulation. When solutions of aluminum sulphate and copper sulphate are mixed and alkali or hard water is added in quantities sufficient to cause precipitation the copper is coagulated at once, while the aluminum is deposited on the copper and incloses it, with the result that the copper-alum coagulum is no more toxic than is the pure alum coagulum. When copper and iron salts are precipitated together the reverse of this seems to take place and the precipitate retains its toxic properties. . . . The presence or absence of carbon dioxid is probably important in this connection."

On the use of Bacillus prodigiosus as an indicator in water examination, R. Hilgermann (*Arch. Hyg., 59 (1906), No. 2, pp. 150–158*).—Investigations of the behavior of this color-producing organism under different conditions are reported which indicate that it is not reliable as a quantitative means of ascertaining the bacterial efficiency of filters.

Prevention of stream pollution by distillery refuse based on investigations at Lynchburg, Ohio, H. Stabler (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 179, pp. 34, pl. 1, figs. 5*).—"This report gives an account of investigations carried on near Lynchburg, Ohio, to discover feasible means of preventing the pollution of streams by distillery refuse. Lynchburg is in Highland County, Ohio, a few hundred yards east of the East Branch of Little Miami River and about 60 miles northeast of Cincinnati. It has a population of a little less than 1,000. Above and below Lynchburg the East Branch of Little Miami River flows through an agricultural district, and as the town has no sewerage system the stream is not seriously polluted except by the distillery refuse. The investigation was therefore confined to the following subjects: (1) The processes at the distillery and the sources of pollution; (2) the effect

of the pollution on the stream; (3) the economical disposal of distillery wastes in such way that there will be no pollution of streams."

As a result of practical trials evaporation of the distillery refuse, using the residue for cattle feed and the distillate as water for mashing, is strongly recommended.

SOILS—FERTILIZERS.

Soil analyses, E. A. MANN (*Jour. Dept. Agr. West Aust., 14 (1906), No. 2, pp. 122, 123*).—Thirty analyses of soils from different parts of Western Australia are reported, with brief comments on the results.

"The principal features of these analyses are: (1) The large number of 'acid' soils. (2) The frequent deficiency in lime. (3) The generally low percentage of total fertilizing constituents. This deficiency is often made up by mechanical conditions favorable for the free penetration of the root system. (4) The relatively large proportion of 'available' to 'total' phosphoric acid and potash in some instances. (5) The lack of humus."

On the composition of soils of French Guiana, A. HÉBERT (*Compt. Rend. Acad. Sci. [Paris], 143 (1906), No. 1, pp. 64–66*).—The results of analyses of 63 samples are briefly summarized, showing that the soils are very variable in physical characteristics and that there is generally a sufficient supply of nitrogen and a great deficiency of phosphoric acid, potash, and lime.

The soils of the Muganj steppe and their transformation into alkali soils, S. SACHAROV (*Zhur. Opuitn. Agron. (Russ. Jour. Expt. Landw.), 6 (1905), No. 2, pp. 176–242, figs 4; Izv. Moscov. Selsk. Khoz. Inst. (Ann. Inst. Agron. Moscou), 12 (1906), No. 2, pp. 226–236; abs. in Centbl. Agr. Chem., 35 (1906), No. 8, p. 567*).—The geological origin and chemical and physical properties of 3 typical soils of this region are described in detail, as well as the characteristic vegetation on each. A considerable proportion of the soils is more or less impregnated with alkali of the neutral white kind composed of chlorids and sulphates of the alkalis and alkaline earths. The distribution of this alkali in the soil under different conditions and the influence of irrigation in causing its spread are discussed, the author comparing his observations on this subject with those of similar character reported by Hilgard.

A contribution to the study of the sand in tropical soils, A. VAN BIJLERT (*Chem. Weekbl., 3 (1906), pp. 413–420; abs. in Chem. Centbl., 1906, II, No. 6, p. 555*).—Determinations of the amount of hygroscopic moisture absorbed from a saturated atmosphere, of nitrogen absorbed from a solution of ammonium sulphate, and amount of matter insoluble in hydrochloric acid and potassium hydroxid of sands and sandy soils from Java are reported.

The author concludes in general from the data obtained that a chemical study of soils is of more importance than mineralogical and mechanical examination.

Influence of cultivation of the soil on the conservation of moisture and the yield of crops, D. CHOUCHAK (*Bul. Agr. Algérie et Tunisie, 12 (1906), No. 12, pp. 237–247, fig. 1*).—An account is given of experiments in the Crimean Peninsula which show that cultivated fallow contained at the end of summer 4 to 6 per cent more moisture than uncultivated.

How long does lime last in the soil? A. D. HALL (*Jour. Bd. Agr. [London], 13 (1906), No. 6, pp. 321–330*).—Data largely derived from observations at Rothamsted are presented to show that the fertility of many English fields to-day "is due to the liming and chalking that was done by the farmers of the eighteenth and earlier centuries."

It is shown, however, that the fertility due to this cause is being steadily

exhausted by cultivation and by percolating rain water. "For example, the Rothamsted soil, which at the beginning of the nineteenth century must have contained something like a hundred tons of chalk per acre, has now less than fifty, and many other soils which started with a smaller initial stock are beginning to run dangerously short. All over the country there is evidence that much of the land, especially on the heavier soils, is in need of liming, and though it would not be wise to return to the old wasteful dressings of 6 to 10 tons to the acre, a much smaller quantity, half a ton or so per acre, could be profitably applied at least once in the course of each rotation."

The chemical and physical action of salt water on soils, D. J. HISSINK (*Chem. Weekbl., 3 (1906), pp. 395–403; abs. in Chem. Centbl., 1906, II, No. 4, p. 352; Jour. Chem. Soc. [London], 90 (1906), No. 528, II, pp. 701, 702*).—Investigations are reported which show that the chemical action of small amounts of salt water, as in case of lands occasionally overflowed by sea water, is in general beneficial in increasing the solublity of most of the soil constituents. The physical effects, however, are not so favorable, the salt water tending to puddle and compact the soil.

The effect of fertilizers on the reaction of soils, F. P. VEITCH (*Science, n. ser., 23 (1906), No. 592, pp. 710–712*).—See E. S. R., 17, p. 431.

On the insoluble alkaline compounds formed in dead leaves, M. BERTHELOT (*Ann. Chim. et Phys., 8. ser., 8 (1906), May, pp. 36–41*).—Investigations are reported which show that dead leaves contain considerable amounts of alkaline compounds insoluble in water, particularly salts of potash, which exhibit the phenomena of double decomposition and equilibrium with solution of salts of weak acids, such as acetic acid.

On the insoluble alkaline compounds formed in the organic matter of soils, M. BERTHELOT (*Ann. Chim. et Phys., 8. ser., 8 (1906), May, pp. 41–45*).—The experiments here reported yielded results similar to those obtained in the case of dead leaves noted above.

On the insoluble alkaline compounds formed by artificial humus compounds of organic origin, M. BERTHELOT (*Ann. Chim. et Phys., 8. ser., 8 (1906), May, pp. 45–51*).—By repeated treatment with hydrochloric acid a humus compound was obtained from soil which contained from 3 to 4 per cent of nitrogen. When this substance was treated with potash solutions a salt was obtained which on prolonged washing lost the major part of its potash but still retained from 3.7 to 6.2 per cent of insoluble potash.

Similar results were obtained with dead leaves and with compost.

Experiments with wood charcoal, M. BERTHELOT (*Ann. Chim. et Phys., 8. ser., 8 (1906), May, pp. 51–57*).—See E. S. R., 17, p. 842.

Irrigating sediments and their effects upon crops, R. H. FORBES (*Arizona Sta. Bul. 53, pp. 55–98, figs. 10*).—This bulletin reports the results of a study of the fertilizing and physical effects of sediments upon soils, in continuation of previous work along this line (E. S. R., 14, p. 423).

In this investigation a study has been made not only of the effect of ordinary stream sediments but of mine tailings from concentrating plants. The streams of the Southwest carry unusually large amounts of sediments, particularly in times of flood. Measurements are reported which show that the Gila River at Florence carries an annual average of 19.23 tons of silt per acre-foot, the Salt River at McDowell 1.2 tons, the Colorado at Yuma 9.62 tons. The amounts of fertilizing materials in these sediments are calculated to be, for the Gila River, 214.3 lbs. per year of potash, 36.9 lbs. of phosphoric acid, and 28.1 lbs. of nitrogen; for the Salt River, 18 lbs. of potash, 6.6 lbs. of phosphoric acid, and 5.5 lbs. of nitrogen; for the Colorado River, 113.1 lbs. of potash, 10 lbs. of phosphoric

acid, and 4.8 lbs of nitrogen. Of course there are wide variations in amount and composition of the sediments at different times.

A study of mine tailings which find their way into the Upper Gila River shows that they differ but little from the natural sediments as regards potash and phosphoric acid, but that they are lacking in nitrogen and organic matter, the constituents most needed in the desert soils.

The most pronounced effect of the free use of irrigation water containing large amounts of sediment is the formation of a silt blanket which interferes with the penetration of irrigation waters and in other ways impairs the physical condition of the soil. Experiments on the effects of these silt deposits on the growth of alfalfa during the summer of 1905 on 3 fields situated respectively under the Colorado River near Yuma, under the Salt River near Phoenix, and under the Gila River near Solomonville, are reported. In case of the field on the Gila River the irrigation water used contained a large amount of tailings from the concentration of copper ores. Observations were also made on a number of alfalfa fields along the Upper Gila River.

The results show in general a marked injurious effect from the accumulation of sediments in alfalfa fields, but like results from the use of water rich in sediments were not in general observed in the case of corn, barley, and wheat. In the case of such crops the ground is cultivated in a manner impossible with alfalfa, and the sediment blanket is broken up, turned under, and incorporated with the soil. In this way the blanketing effect is lessened or entirely done away with and the sediments are left free to exert such fertilizing influence as they may possess. It is therefore concluded that "in all cases cultivation, as deep, thorough, and frequent as practicable, is the prime means both of utilizing beneficial sediments and of mitigating the effects of harmful ones."

As compared with the natural sediments the mine tailings were of little or no fertilizing value and were fully as injurious from the standpoint of the physical properties of the soil. Certain injurious effects which have been popularly ascribed to mine tailings are shown to be due to other causes, such as plant diseases of various kinds, which have no relation to the water sediments. It is believed, however, that sunburning of crops, which is common throughout the Southwest, is due largely to the use of turbid irrigating waters.

Methods of lessening sediments in irrigating waters, especially the use of settling basins, are briefly discussed, and it is stated that "it is probable that, to an increasing extent, settling basins will be found a necessary adjunct to irrigating systems in the Southwest." In this connection mention is made of settling basins at present in use along the Colorado and Gila Rivers, and a brief account is given of the remains of prehistoric settling basins along the Salt River.

Assimilation of nitrogen by leguminous plants (*Nature* [*London*], *74* (*1906*), *No. 1923, p. 475*).—A brief reference is given to experiments at Midland Agricultural and Dairy College of England with Hiltner's pure cultures on tares, peas, alsike clover, alfalfa, and crimson clover grown in pots of boiled, sterilized quartz sand.

Inoculation proved beneficial in all cases. A method of inoculation which consists in mixing dried sterilized soil with crushed healthy nodules from the roots of plants of the same kind as those which it is desired to inoculate is described.

On the influence of bacteria on the metamorphosis of nitric acid in the soil, J. STOKLASA, J. JELINEK, and A. ERNEST (*Ztschr. Landw. Versuchsw. Österr., 9* (*1906*), *No. 8, pp. 844–851; abst. in Chem. Ztg., 30* (*1906*), *No. 90, Repert. No. 43, p. 386*).—This is an account of a continuation of previous studies (E. S. R., 18, p. 215) and deals with the evolution of carbon dioxid and free nitrogen in Giltay

nutrient solutions, with and without addition of glucose and citric acid inoculated with soils of different kinds, especially those used in sugar-beet culture.

The conclusion is reached as in previous investigations that the organic matter occurring in such solutions as those experimented with does not furnish a readily available source of carbon for the respiration processes of denitrifying organisms and consequently nitric acid is not reduced to an appreciable extent in such soils. The authors are of the opinion that the decomposition products of the carbohydrates under the influence of micro-organisms are lactic acid, alcohol, and carbon dioxid, the decomposition of nitric acid in presence of alcohol taking place according to the following formula: $C_2H_6O+2N_2O_3=2CO_2+4N+3H_2O$.

Investigations on anaerobic nitrogen-collecting bacteria, E. Haselhoff and G. Bredemann (*Landw. Jahrb., 35 (1906), No. 3, pp. 381–414, fig. 1; abs. in Chem. Ztg., 30 (1906), No. 57, Repert. No. 21, p. 223; Jour. Chem. Soc.* [*London*], *90 (1906), No. 528, II, p. 698*).—The authors report studies of (1) the occurrence and distribution of anaerobic bacteria similar to Winogradski's *Clostridium pasteurianum* in soils and on the leaves of various cultivated plants; (2) the capacity of these organisms to fix free nitrogen; and (3) the characteristics of the organisms as compared with *C. pasteurianum.*

The Clostridium forms of organisms were found to be widely distributed in soils and on the leaves of forest trees; in fact they were found in all of the samples examined. Pure cultures were isolated from cultivated soils. Both mixed and pure cultures of the organisms showed rates of assimilation of nitrogen similar to those observed by Winogradski with *C. pasteurianum.*

Calculated to 1 gm. of dextrose or mannite the amount of nitrogen fixed was according to Winogradski (*C. pasteurianum*) 2 to 3 mg., according to Beijerinck (Azotobacter, mixed culture) as high as 6.93 mg., Vogel (Azotobacter in mannite solution) 8.52 mg., Gerlach and Vogel (Azotobacter, pure culture) 8.9 mg., Haselhoff and Bredemann (mixed and pure cultures) 0.42 to 2.74 mg.

A morphological description is given of the isolated organisms and experiments which have been undertaken to determine the agricultural conditions best suited to the activity of the organisms are referred to. The methods used in obtaining the Clostridium cultures are fully described.

Formation of crystals in cultures of denitrifying bacteria, H. B. Hutchinson (*Centbl. Bakt.* [*etc.*], *2. Abt., 16 (1906), No. 10–13, pp. 326–328; abs. in Jour. Chem. Soc.* [*London*], *90 (1906), No. 525, II, p. 477; Chem. Centbl., 1906, II, No. 7, p. 621*).—"Cultures of bacteria from garden soil in Giltay solutions produced skins consisting of acicular crystals of magnesium phosphate and became strongly alkaline. Denitrification was not vigorous. The alkalinity, which is presumably due to production of sodium carbonate from the citric acid, became equal to that of a tenth-normal solution in four weeks. The alkalinity and the amount of crystals seem to increase with increased surface and aeration."

The new nitrogenous fertilizers, J. Sebelien (*Tidsskr. Norske Landbr., 13 (1906), No. 2, pp. 49–81*).—The article contains a summary of recent fertilizer trials with calcium cyanamid and lime niter in comparison with nitrate of soda and ammonium sulphate, and also reports on similar experiments conducted by the author and B. R. Larsen at Aas Agricultural College. The fertilizing effect of lime niter and nitrate of soda was found to be approximately the same, the small variations observed being attributable to differences in the character of the soils experimented with.

Pot experiments were made with oats on sandy soil, with oats and barley

on sandy soil mixed with clay, and with mustard and carrots on sandy soil. In several instances lime niter produced somewhat better results than nitrate of soda. This was due to the lime which it contained in addition to its nitrogen, as shown by the fact that pots fertilized with nitrate of soda and calcium carbonate gave higher results than nitrate alone, and as a rule results similar to those obtained from a corresponding amount of lime niter.

The author concludes that there is no reason to expect any difference in the fertilizing effect of a lime niter free from lead, and a nitrate of soda free from perchlorate and similar poisonous substances.—F. W. WOLL.

Nitrogenous fertilizers in 1905, K. RORDAM (*Tidsskr. Landökonom., 1906, Nos. 7, pp. 401–408; 8, pp. 433–452*).—A discussion of the various nitrogenous fertilizers on the market, and especially of calcium cyanamid and lime niter, their method of manufacture, comparative fertilizer value, and the prospects of their future importance.—F. W. WOLL.

The oxidation of atmospheric nitrogen in the electric arc, F. M. PERKIN (*Nature [London], 74 (1906), No. 1922, pp. 444–446, figs. 4*).—A brief account of various methods of electrical oxidation of the nitrogen of the air, but particularly of the Birkeland and Eyde process as developed at Notodden, Norway.

The utilization of water power in the electro-chemical manufacture of fertilizers, CÔTE (*Ann. Soc. Agr. Sci. et Indus. Lyon, 1905, pp. 215–271, figs. 4*).—A general discussion of this subject from the standpoint of rural economics, the synthetic preparation of nitric acid and cyanamids, liquefaction of air, and manufacture of copper salts.

Calcium cyanamid (Kalkstickstoff), H. FRANK (*Pure Products, 2 (1906), No. 8, pp. 446–454*).—This is a translation of a lecture before the Agricultural Club of Berlin, which describes briefly the methods of preparing this substance and its use as a fertilizer.

Results of tests of calcium cyanamid as a fertilizer (*Risultati di alcune prove di concimazione con calciocianamide. Rome, 1906, pp. 44, figs. 27*).—This is a compilation of experiments with this material on a number of different crops by various investigators.

Lime nitrogen, nitrogen lime, and nitrate of lime, GERLACH (*Deut. Landw. Presse, 33 (1906), No. 44, p. 365*).—The use and value of these products are briefly discussed.

Chilean nitrate deposits (*Jour. Franklin Inst., 162 (1906), No. 2, p. 159*).—A brief note is given on the opinion commonly held by Chilean miners that the formation of nitrate deposits is due to atmospheric electricity. It is stated that "there is a remarkable amount of mist surcharged with electricity in the Pampas, where the saltpeter is mined, so much so that telephones are deranged. Apparently the ozonized air disengages nitrate of ammonia, which combines with rock salt to form saltpeter."

The Chilean nitrate of soda industry and the new cartel, P. KRISCHE (*Fühling's Landw. Ztg., 55 (1906), No. 16, pp. 563–568*).—A general discussion of the condition of this industry with special reference to the nitrate supply of Germany.

Mountains of saltpeter, H. H. DUNN (*Tech. World Mag., 5 (1906), No. 4, pp. 397–401, figs. 4; abs. in Amer. Fert., 25 (1906), No. 3, pp. 10–12*).—The deposits of nitrate occurring in Death Valley, California, are described.

The utilization of peat bogs for the intensive production of nitrates, A. MÜNTZ and E. LAINÉ (*Compt. Rend. Acad. Sci. [Paris], 142 (1906), No. 23, pp. 1239–1244; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 525, II, p. 476*).—Experiments are reported which show that "when a 0.75 per cent solution of ammonium sulphate is passed over a peat bed impregnated with nitrify-

ing organisms, it becomes charged with nitrates to the extent of 0.82 per cent. This can be increased to 4.17 per cent by adding a further quantity of ammonium sulphate to the solution and again subjecting it to the nitrifying action, the operation being repeated 5 times. The most suitable temperature for the reaction is 30°, and the fuel necessary for maintaining this temperature is afforded by the air-dried peat. Further, the nitrogen contained in the peat, which amounts to 2 to 3 per cent, can be obtained in the form of ammonia to the extent of 1.79 to 1.612 per cent by distilling the peat in superheated steam, the other products of the distillation (hydrocarbons, water gas, tar, etc.) forming the fuel required for the operation.

"Peat, therefore, is singularly well adapted for the intensive production of nitrates, since it forms an excellent medium for the growth of the organism, supplies the fuel necessary for the various operations, and finally supplies the ammonia required for the production of nitrates."

Nitrate of soda and nitrate and nitrite of lime in field experiments at Parc des Princes, 1906, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 11 (1906), No. 25–26, pp. 753–755*).—Comparisons of nitrate of soda with nitrate and nitrite of lime obtained from the Notodden factories in Norway on corn and potatoes are reported. The results show that in general the Notodden products compare favorably with nitrate of soda, and that there is no injurious effect from the use of the nitrite as a fertilizer.

The action of nitrite on plants, A. STUTZER (*Jour. Landw., 54 (1906), No. 2, pp. 125–138; abs. in Chem. Centbl., 1906, II, No. 4, p. 353*).—Experiments are reported which show that nitrite injuriously affects germinating seeds, but that the injury varies with the kind of plant. Young beet plants are especially affected. Red clover at the end of the germinating period is resistant. With older plants the nitrite is not injurious and is in some cases less effective, in other cases more effective than nitrate as a source of nitrogen. The author believes that in the preparation of nitrogen compounds by means of electricity effort should be made to obtain a product as free from nitrite as possible.

Use of ammonium sulphate as a fertilizer, BACHMANN (*Fühling's Landw. Ztg., 55 (1906), No. 13, pp. 451–459*).—Experiments are reported in continuation of those of previous years (E. S. R., 16, pp. 245, 860) which show that in case of rye one early spring (end of March) application of ammonium sulphate gave on the whole better results on both loam and sandy soils than fall or late spring applications. The same was true in case of summer cereals and beets.

The action of ammonium sulphate, especially in case of later applications, is controlled to a large extent by the rainfall during the season. Results were not conclusive as to the best depth of application for summer crops, but indicated that it should probably be deeper on loam soils than on sandy soils.

Production of sulphate of ammonia (*Jour. Bd. Agr. [London], 13 (1906), No. 6, pp. 359, 360*).—The production of this material in the United Kingdom during 1905 is given as 269,114 tons as against 245,990 tons in 1904. The average price in 1905 was about $61 per ton.

Use of gypsum in the recovery of ammonia as a by-product in coke making, H. WARTH (*Chem. News, 93 (1906), No. 2428, pp. 259, 260; abs. in Jour. Soc. Chem. Indus., 25 (1906), No. 14, p. 686*).—The use of calcium sulphate is recommended for the recovery of ammonia from gas liquor when large quantities of sulphuric acid are not available.

In experiments reported a sample of gas liquor containing 2.6 gm. of ammonia per 100 cc. was well shaken with gypsum, allowed to settle, and the clear liquid drawn off. From this clear solution it was found possible to recover 97 per cent of the ammonia present in the original gas liquor, namely,

17 per cent by boiling the solution and absorbing the ammonia evolved in sulphuric acid and 80 per cent in form of crystallized ammonium sulphate by concentrating the residual solution.

In order to dispense entirely with the use of sulphuric acid, the gas liquor was first treated with gypsum, the solution drawn off and treated with ferrous sulphate, the precipitated ferrous sulphide removed, and the clear solution evaporated to obtain crystallized ammonium sulphate. In this way it was found possible to recover 95.4 per cent of the total ammonia.

Further results of fertilizer experiments with agricultural phosphate, H. Bachmann (*Jour. Landw., 54 (1906), No. 3, pp. 301–307; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 528, II, pp. 702, 703*).—Field experiments on two sandy soils with rye and beets in continuation of those previously reported (E. S. R., 17, p. 17) are here recorded. The results are not entirely conclusive, but indicate that amorphous agricultural phosphate (fine-ground raw phosphate) is almost equal to Thomas slag in the first and second years. The action of apatite ceased after the first year.

Composition of deposits of phosphate of lime in the United States, P. Jumeau (*Ann. Chim. Analyt., 11 (1906), Nos. 6, pp. 211–216; 7, pp. 256–261; abs. in Chem. Centbl., 1906, II, No. 8, p. 705*).—This is a continuation of an article previously noted (E. S. R., 18, p. 22) and deals with the plate rock, soft and pebble phosphates of Florida, and with Tennessee, South Carolina, and various minor phosphate deposits, including among the latter those of North Carolina, Pennsylvania, Arkansas, Alabama, Wyoming, Porto Rico, and Canada. Statistics of production, composition, etc., are given.

Granite rock potash (*Amer. Fert., 25 (1906), No. 2, pp. 16, 17*).—This is a reprint of an article by C. G. Hopkins, of the Illinois Station, which maintains that "while there is reason to believe that heavy applications of finely ground granite rock carrying a considerable percentage of potassium can be used with profit on certain soils, and for certain crops under suitable conditions, it is unfortunate that such misleading and exaggerated statements should be made as . . . are published in several daily papers."

It is shown that 1 ton of potassium chlorid, at \$40 to \$50 per ton, contains as much potash as 10 tons of granite at \$8 per ton. "At \$8 a ton for granite and \$50 a ton for potassium chlorid, the amount of insoluble potassium which can be purchased in a ton of granite for \$8 is no greater than the amount of soluble potassium which can be purchased in 200 lbs. of potassium chlorid for \$5. The fact that the granite is insoluble, and very slowly available, while the potassium chlorid is soluble in water and readily available, more than counterbalances the difference in cost. Furthermore, the cost of transportation and application of one ton of granite as compared with 200 lbs. of potassium chlorid will also, in most cases, more than counterbalance the difference in cost."

Experiments by the Maine and Vermont stations are cited to show that the potash of granite dust and ground feldspar has a rather low fertilizing value.

Potassium mining crisis, T. J. Albert (*Mo. Consular and Trade Rpts. [U. S.], 1906, No. 309, pp. 77–80*).—The conditions which render it probable that the combination which now controls the output and price will break down are briefly discussed.

The use of lime and magnesia as fertilizer, O. Loew (*Landw. Jahrb., 35 (1906), No. 4, pp. 527–540; abs. in Chem. Ztg., 30 (1906), No. 70, Repert. No. 29, p. 287*).—Experiments tending to show the necessity of maintaining in the soil a certain relative proportion of lime and magnesia and of keeping the latter in the less injurious forms (preferably carbonate) are reviewed and discussed. The importance of applying magnesia in some cases of excess of lime in the soil is pointed out.

Analyses and valuations of commercial fertilizers, J. P. Street, W. P. Allen, and V. J. Carberry (*New Jersey Stas. Bul. 196, pp. 35*).—This bulletin reports analyses of 265 brands of complete fertilizers, 102 samples of unmixed fertilizing materials, 5 home mixtures, and 26 special fertilizers examined during the spring of 1906.

Fertilizers and feeding stuffs act, 1906 (*Mark Lane Express, 95 (1906), No. 3911, pp. 274, 275*).—The text of the revised British act is given and the principal points on which it differs from the old are briefly summarized.

AGRICULTURAL BOTANY.

Flora of Colorado, P. A. Rydberg (*Colorado Sta. Bul. 100, pp. XXII + 448*).—This catalogue of species is based mainly upon the collections of the agricultural college at Fort Collins and the herbaria at the New York Botanic Garden, with additional records secured from other sources. The author has presented keys to the genera and species and under the specific name gives briefly the habitat and distribution of the plant.

The publication as presented stands as a brief index of the present knowledge of the flora of the State, and it is believed that it will be of use to all systematic botanists, to the schools of the State, and to all interested in the economic study of Colorado plants or in the flora of the plains and mountains of Colorado.

Rôle of seed coats in delayed germination, W. Crocker (*Bot. Gaz., 42 (1906), No. 4, pp. 265–291, figs. 4*).—A study has been made of some of the causes of delayed germination which is reported in seed of many plants, and contrary to the common view that the cause is generally to be found in the embryo the author finds that the structure of the seed coats is the determining factor.

Specific instances are given of delayed germination due to various peculiarities of seed coats. The author finds that seed coats which exclude water are much more liable to delays in germination than are seed coats which exclude oxygen. In nature, growth of delayed seeds comes about by the disintegration of the seed coat structures by longer or shorter exposure to germinative conditions.

In the case of seeds of the hawthorn there were found to be characters in the embryo which delayed germination, and in these instances the germination finally comes about through long exposure to germinative conditions but not in dry storage. The phenomena in delayed germination in the case of the cocklebur, various species of Plantago, and other plants are described.

The influence of sunlight and diffused light on the development of sugar beets, S. Strakosch (*Separate from Österr. Ungar. Ztschr. Zuckerindus. u. Landw., 1906, No. 1, pp. 11, figs. 2*).—The sugar beet, it is claimed, can form all the starch necessary to its growth in very diffused light. Nevertheless direct sunlight stimulates the formation of substances in the plant such as starch. A lack of direct sunlight increases the nonsugars in the beet juice as well as reduces the total sugar content. The latter, however, is not influenced in the same proportion as is the total size of the beet root.

Under similar conditions there is a greater amount of intracellular respiration in normal leaves than in those grown in greatly diffused light, although the latter show a stronger epidermal transpiration. In comparing sun and shade produced leaves the stomata of those grown in full light were found to be larger, and relatively more stomata were found on the upper and fewer on the lower sides of the leaves.

Translocation of the results of assimilation was continued longer in the case of shade-produced leaves. With an increase in light intensity there was found a

diminution of monosaccharids as compared with disaccharids. Dextrose is associated with the monosaccharids of the beet leaves. There are indications that cane sugar is not an intermediate product of beet leaves, but is a reserve capable of translocation to other parts of the plant. This the author expects to investigate more fully.

Injurious action of acetates and formates on plants, K. Aso (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 13–24*).—The author states that free acetic and formic acids even in considerable dilution are injurious to plants, although it was not to be expected that the sodium and calcium salts of these acids in moderate concentration would prove injurious to phanerogams. The effect of various acetates and formates was found to differ very materially from that of the oxalates, and marked differences were observed in the behavior of acetates and formates toward flowering plants and algæ.

Experiments were carried on with various algæ, seedlings of sorghum, onions, peas, barley, young branches of oak, and other plants, to show that the acetates and formates of alkaline metals and calcium act injuriously on flowering plants in solutions of 0.5 per cent or over, while under the same conditions they are not injurious to the higher algæ. Neutral potassium acetate of the same concentration is poisonous to both phanerogams and higher algæ.

The poisonous action of acetates and formates is held to be caused by the hydrolytic dissociation of these salts into acids and bases in the living cells, whereby the base is absorbed by the proteids and the acid being set free injures the protoplasm.

Stimulating influence of sodium fluorid on garden plants, K. Aso (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 83, 84*).—Pot experiments with seeds of a number of plants were carried on, which showed the stimulating effect of small quantities of sodium fluorid. The flowers appeared first in the pots which contained 0.02 gm. sodium fluorid. But little difference was noticed, however, in the size of the flowers in the treated and untreated pots.

The stimulating action of calcium fluorid on phanerogams, K. Aso (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 85–90, pl. 1*).—In other experiments the author has found that sodium fluorid acts as a strong poison on seeds and seedlings, although it exerts a stimulating effect on their development when highly diluted.

The fact that in soil cultures sodium fluorid passes readily into calcium fluorid, which is but slightly soluble, renders it probable that the stimulating compound in soil cultures is not sodium fluorid, but calcium fluorid. In order to determine this, experiments were made with peas and barley, which showed that calcium fluorid is formed in the soil when sodium fluorid is applied, and that as it is slightly soluble in water it can act as a stimulant of plant growth.

The degree of stimulating action of manganese and iron salts on barley, T. Katayama (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 91–93, dgm. 1*).—Investigations with oats, upland rice, barley, and wheat have shown that the stimulating effect of manganese salts is less on cereals than on leguminous plants. Experiments were conducted to determine the amount of manganese salt necessary to produce as favorable results on the common cereals as have been obtained with this salt when applied to peas.

When fractional doses of high dilution were applied as top dressing, the results showed that 0.01 per cent of manganese and iron sulphates produced a moderate increase in the harvest of barley, but that a further increase led to a general decrease in yield.

The micro-organisms of natto, S. Sawamura (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 1, pp. 107–110*).—Natto, which is a kind of vegetable cheese

prepared by the fermentation of boiled soy beans, contains large amounts of mucilage, and the viscosity of the mixture is especially esteemed.

A study was made by the author to determine the bacteria present, and although many species were found to grow on soy beans, the genuine natto could be produced only by the presence of 2 species, which are designated as Bacillus No. 1 and Bacillus No. 2. It is probable that for the formation of good natto cheese both species must be present.

In order to test for enzyms produced on soy beans by the bacteria, precipitates were made and tested, in which way it was found that the enzym was of a tryptic nature. Bacillus No. 2 also produced a diastatic enzym, and from these facts it is inferred that natto may have some beneficial influence on digestion.

The drug known as pinkroot, W. W. Stockberger (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 100, pt. 5, pp. 8, pls. 2, figs. 2*).—The drug known as pinkroot (*Spigelia marilandica*) came into use in America about 1723, and because of its valuable properties soon came to occupy an important place in materia medica. Conflicting reports on its physiological effects appeared from time to time, and its use has greatly decreased.

The cause of the apparent loss of high efficiency has been a subject for study for some years, and it is demonstrated that a substitute has to a considerable degree replaced the true article. This explains in a large measure its unfavorable commercial and medical status.

Results are outlined in the bulletin of a detailed study of the pinkroot and its more important adulterants, which may serve to aid collectors and drug experts in distinguishing the plant from its sophistications.

International catalogue of scientific literature. M—Botany (*Internat. Cat. Sci. Lit., 4 (1906), pp. VIII+951*).—This is the fourth annual issue of the catalogue of scientific papers compiled and published by the International Council of the Royal Society of England, and includes the literature of 1904 with some titles omitted from previous issues. About 4,600 titles are enumerated, the plan of grouping being about the same as that previously noted (E. S. R., 14, p. 637; 17, p. 752).

FIELD CROPS.

Report of work at McNeill Branch Experiment Station, E. B. Ferris (*Mississippi Sta. Rpt. 1905, pp. 31-35*).—The work of the station for the year is briefly noted.

The results of fertilizer experiments showed that on the land parked with cattle during the winter of 1902-3 there was a yield of 1,300 lbs. more of seed cotton per acre than on three check plats. As a fertilizer for cowpeas acid phosphate alone gave practically as good yield as a complete fertilizer, and drilling ½ bu. of seed produced as much pea hay as the use of 1 bu. of seed per acre. Good stands of alfalfa, crimson clover, and hairy vetch are reported. The hairy vetch was sown in the fall of 1902 and is reported as being in a most promising condition. Inoculating the vetch field produced a more vigorous growth and a good stand.

Subsoiling at the station has not shown any very marked results. This year 35.7 bu. of corn and 900 lbs. of seed cotton were obtained on land prepared 5 in. deep, and 37.1 bu. of corn and 1,025 lbs. of seed cotton per acre on land broken 18 in. deep during the spring of 1903. Rotation tests now in progress for 3 years with cotton, corn, oats, and cowpeas resulted during the last year on the rotation plat in a yield of 904 lbs. of seed cotton per acre as compared with 724 lbs. on a plat similarly fertilized but growing cotton continuously for the same length of time.

The work with small fruits, vegetables, Bermuda grass, cassava, sugar-cane, and live stock is briefly outlined.

Five years' results on the sewage irrigation fields of Arad, J. GYÁRFÁS (*Ztschr. Landw. Versuchsw. Österr., 9 (1906), No. 9, pp. 859–890*).—A history is given of the sewage irrigation field and its management is described.

Vegetable culture gave in general unsatisfactory results. Kale for forage, poppy, corn grown for grain, and potatoes were also unprofitable. The sunflower was observed to transpire greater quantities of water than any other crop grown on the field. It made a very luxuriant growth, but was unprofitable on account of the difficulties in the way of its use. Broom corn produced brush from 60 to 100 cm. long and of the required degree of fineness. The yield of hemp under sewage irrigation was lower than the average yield for the entire country, but the fiber secured was of proper quality. Barnyard millet made an extremely heavy growth, while sugar beets were not successful. Fodder beets were the only hoed crop which gave good returns. Ridge culture for the fodder beet produced better yields than level culture, and beets grown from the seed without transplanting were more successful than transplanted beets.

Errors in field tests due to lack of soil uniformity, G. HOLTSMARK and B. R. LARSEN (*Landw. Vers. Stat., 65 (1906), No. 1–2, pp. 1–22, dgms. 4*).—This article, previously noted in E. S. R., 17, p. 963, appears here in German.

The Svalöf method for breeding agricultural plants and its relation to the theory of selection, H. DE VRIES (*Separate from Arch. Rassen u. Gesell. Biol., 3 (1906), No. 3, pp. 345–358*).—A detailed description is given of the method followed at Svalöf in improving agricultural plants. The matter presented is compiled with a view to discussing from a scientific standpoint the value of the principle of selection in plant improvement.

The chemical composition of Washington forage crops, R. W. THATCHER (*Washington Sta. Bul. 72, pp. 27, dgm. 1*).—The experiments in progress have for their object the determining of the chemical composition of the hay crops as now cured in the eastern sections of the State, the variations and composition of hay from the same plant when grown under different conditions and in different sections, the analyses of several of the leading forage crops of the State in different stages of maturity, and the effect of different conditions and methods of curing upon the chemical composition of the hay. These investigations will require several years of study, and this bulletin is a report of only the first year's work.

The samples analyzed are briefly described and the composition of grass hay, grain hay, hay from leguminous crops, fodders, silage, and root crops, as determined by analyses, is given in tables. The digestible nutrients in the feeding stuffs analyzed are also shown.

The analyses show that the common grass hays, grain hays, and alfalfa hay contain about the same amounts of total digestible nutrients, but in widely different proportions, the grass hays being richest in carbohydrates and alfalfa richest in protein, while the grain hays contain these substances in a fairly well-balanced proportion for a maintenance ration. The analysis of timothy hay shows a surplus of carbohydrates and that of alfalfa of protein. It is stated that neither timothy nor alfalfa can be fed alone without waste. Alfalfa hay from irrigated sections appeared to be richer in protein than that grown without irrigation. It was also found that the total nutrients of alfalfa hay were about the same regardless of the stage of growth at which the crop was cut, but the proportion of protein was much greater when the crop was cut early than when cut late. From these results it is concluded that the riper the crop gets the more nearly it approaches to a balanced ration and the safer and

more economical is its use alone; but attention is called to the fact that beyond full bloom the proportion of crude fiber increases rapidly, with a corresponding decrease in total digestible nutrients. Alfalfa hay from the first, second, and third crop had apparently about the same composition if cut at the same stage of growth.

Some reasons for failure with alfalfa, T. L. LYON (*Cornell Countryman, 4 (1906), No. 1, pp. 3-6, figs. 3*).—Experiments were conducted to determine the causes of failure in alfalfa culture, and the practical suggestions derived from the results were that at least a moderately fertile soil is needed for this crop, that the use of phosphate as a fertilizer is valuable in this connection, and that inoculation is futile unless the soil is in a condition to favor the growth of the bacteria.

Adulteration of alfalfa seed, B. T. GALLOWAY (*U. S. Dept. Agr., Office Sec. Circ. 20, pp. 2*).—This circular reports on the examination of 352 samples of alfalfa seed obtained in the open market. Of these 160 contained dodder seed. 9 were adulterated with seed of yellow trefoil, and 9 with bur clover. The quantity of yellow trefoil found in the adulterated samples ranged from 3.75 per cent to 47.05 per cent, and that of bur clover from 1.12 to 20.28 per cent. The quantity of total adulterants found varied from 7.65 per cent to 53.28 per cent.

Tables for the determination of the protein content of barley, E. GLIMM (*Bromberg and Leipsic: E. Hecht'sche, 1907, pp. 272, figs. 4*).—Tables are given for the ready calculation of the protein content of the dry matter of barley after the analytical results have been obtained. These tables are applicable in all cases where the water content ranges from 10 to 17.90 per cent.

Brief directions for the determination of nitrogen are also given.

Culture tests with brewing barley, J. BEHRENS (*Ber. Landw. Vers. Anst. Augustenb., 1905, pp. 60-67, 90-109*).—Cooperative culture tests showed that common local varieties of barley failed to equal in quality and producing capacity the introduced varieties with which they were compared. This is believed to be due rather to improper seed selection than to a defect in the varieties. Chevalier barley was so unsatisfactory in both quality and yielding power that the variety is not recommended for general cultivation. The best results in quality and quantity for 3 years were secured with Goldthorpe, Hanna barley standing next.

Continuous corn culture, G. E. ADAMS and H. J. WHEELER (*Rhode Island Sta. Bul. 113, pp. 99-114*).—In the spring of 1894 the station decided to devote an acre of land to the continuous culture of corn.

The soil was partly a silt loam and partly a light sandy loam. The first 2 years only chemical fertilizers were used, the maintenance of soil humus being placed upon the corn stubble remaining upon the field. The following 2 years half of the area was sown with crimson clover at the time of the last cultivation of corn and half to rye, in order to compare the merits of a leguminous and nonleguminous crop as a means of maintaining soil humus. Beginning with 1898, after the experiment had been in progress 4 years, the first quarter of the acre plat was sown to crimson clover and the third quarter to winter rye at the time of the last cultivation of the corn, while the second and fourth quarter acre received no cover crop. In 1899 the land was limed to insure the success of clover. The history of the land is given and the fertilizer treatment and the results secured in each year are recorded.

A summary of the results during the 12 years the experiment has been conducted shows that the gain from using clover as a cover crop, after deducting the cost of the seed, was \$50.24, or an average of \$4.19 per acre annually, as compared with \$4.28, or an average of \$0.36 an acre annually from using rye,

Cotton culture in its relation to climate near the limits of the cotton belt, W. R. ECKARDT (*Inaug. Diss., Univ. Jena, 1906, pp. 115*).—The relation of the different climatic factors to the culture of cotton in the northern and southern hemispheres is discussed.

Special attention is given to cotton culture in the United States and the climatic conditions of this country are compared with those of Europe. In his discussion on cotton growing in the southern hemisphere the author points out the favorable climatic conditions in the German-African colonies for the culture of this crop.

A new type of red clover, C. J. BRAND (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 95, pp. 45, pls. 3, figs. 2*).—This bulletin describes the performance and characteristics of a strain of red clover obtained from Orel, in the Black Earth region of Russia. Cooperative experiments have been carried on with this strain and with other red clover secured from various sources in this country and Europe, in Minnesota, North Dakota, South Dakota, Nebraska, Indiana, Ohio, and the Province of Ontario, Canada, and the results are here discussed.

The average purity of seed used in the experiments was 98.13 per cent. The seed showing the highest percentage of purity was secured from Oregon, which was 99.68 per cent pure, while the seed grown in New York contained the highest percentage of impurities, 7.46 per cent, or 92.54 per cent of pure seed. The average germination of all samples was 87.07 per cent, the range being from 58.2 per cent for seed from Courland, Russia, to 99.12 per cent for seed from eastern Ohio. A detailed description of the experiments carried on in each State is given.

A description of the new Russian type is given and its advantageous characters discussed. The designation *Trifolium pratense foliosum* is proposed. It is stated that this variety is distinguished by the dustlessness of its hay, due to the almost complete absence of hariness; by its heavy yield for the first crop; by its leafiness and the persistency of the basal leaves, on which character the proposed varietal name is based; by the succulence of its stems; by the greater palatability as compared with hay from domestic seed; and by a later period of maturity, the harvest of this new type coming from 10 days to 2 weeks later than that of our ordinary red clover.

Reports received during 1906 confirm the observations made during the previous year. Reports during the present year on the growth of this variety, also referred to as Russian clover No. 16, on a Nebraska farm show that the plant has a tendency to become perennial. Of the different kinds of seed sown in 1904 the Russian clover No. 16 was the only strain that had a full stand from the first seeding.

Seed of red clover and its impurities, E. BROWN and F. H. HILLMAN (*U. S. Dept. Agr., Farmers' Bul. 260, pp. 24, figs. 39*).—This bulletin describes red clover seed and also gives descriptions of the more common impurities in the American and European grown article.

The extremes of good and bad seed are shown by the analyses of two samples, one of which, imported at $5\frac{1}{5}$ cts. per pound, contained about $18\frac{1}{4}$ per cent of seed that would grow, though most of this was so inferior that it would not produce vigorous plants, while the other sample contained more than 95 per cent of seed that would grow and was practically free from weed seed. It is pointed out that in order to sow the same amount of good seed it would require $5\frac{1}{4}$ lbs. of the poor sample to 1 lb. of the other, and that every time 150 weed seeds were sown with the good sample, 733,567 weed seeds would be sown with the poor one.

It is stated that the average seed grown in this country contains about 300,000 seeds to the pound, seed produced in England about 222,000, that produced in Chili about 190,000, and that very poor seed often contains as many as 490,000 seeds to the pound.

A short treatise on the culture and handling of flax, B. STEGLICH (*Dresden: C. Heinrich, 2. ed., pp. 15*).—Brief notes on flax culture with reference to climate, soil, rotation, cultivation, fertilization, seed, and harvesting are given, together with concise directions for retting, drying, and marketing the crop.

The influence of external conditions on hemp and hemp fiber, J. BEHRENS (*Ber. Landw. Vers. Anst. Augustenb., 1905, pp. 41-43*).—The results of the experiments here described indicate that the free access of light fails to influence the development of fiber in the hemp plant.

A comparison of Improved Ligowo and Provence Gray oats, F. RICHTER (*Prog. Agr. et Vit. (Ed. l'Est), 27 (1906), No. 45, pp. 567-570*).—In culture tests of these varieties the Provence Gray yielded 2,450 kg. per hectare and the Ligowo 3,270 kg. The hectoliter weight of the Ligowo was 43.5 kg. and that of the Provence Gray 43 kg.

It is concluded from the results secured that Ligowo Improved might be recommended for general culture either as a winter oats in southern localities or as a spring variety in the more northern regions.

Orchard grass, R. A. OAKLEY (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 100, pt. 6, pp. 16, pl. 1*).—This bulletin describes the methods followed in growing orchard grass for hay, pasture, and seed in different sections of the country.

It is stated that orchard grass yields on an average from 10 to 12 bu. of seed per acre, which sells for $1.25 a bushel. When sown for seed it is advised to sow 1 bu. of seed per acre, and when grown for hay or pasture to use more than this quantity. Red clover sown with orchard grass at the rate of 1 bu. to 5 or 7 acres is considered a profitable mixture. Orchard grass sown together with tall meadow oat grass and meadow fescue for hay and pasture also gives good results. The seed is harvested about June 15 to June 25. The average life of an orchard grass meadow is given as from 5 to 7 years.

Potato culture experiments, J. BEHRENS (*Ber. Landw. Vers. Anst. Augustenb., 1905, pp. 57-60*).—The results secured showed that there existed no definite relation between the weight of the seed tubers and the yield. The seed tubers weighing 100 gm. each gave a higher average yield than those weighing less, but the exceptions were very numerous. The starch content of the seed tubers and that of the product secured seemed to bear no relation to each other. The starch production of individual plants was also apparently independent of the starch content of the seed tubers.

Sugar beets in Kansas (*Quart. Rpt. Kans. Bd. Agr., 25 (1906), No. 99, pp. 32, figs. 6*).—A series of articles giving the history and the present status of the beet-sugar industry in Kansas, with a record of its progress since the passage of the State bounty law in 1901. General directions on the culture of the sugar beet are included, and growing sugar beets in the Arkansas valley in Kansas is described.

Report on fertilizer tests with sugar cane, C. LEMARIÉ (*Bul. Écon. Indo-Chine, n. ser., 9 (1906), No. 53, pp. 629-635*).—Fertilizer experiments were conducted on naturally poor soils, especially deficient in humus.

The results showed that minerals alone were ineffective and that where insufficient quantities of barnyard manure were used the returns were also unprofitable. A heavy dressing of barnyard manure gave a somewhat smaller yield, but was nevertheless more profitable than an application of barnyard manure together with commercial fertilizer. The author concludes that the first need of the soil is a supply of humus.

Sunflower culture and its profits in Russia, V. WALTA (*Fühling's Landw. Ztg., 55 (1906), No. 20, pp. 701-708, fig. 1*).—The history of sunflower culture in Russia is given, together with a description of the methods followed. The quan-

tities of plant food taken from the soil by the crop are shown and the cost of sunflower production, together with the yields of seed and oil, are discussed.

Fertilizer experiments with tobacco, J. BEHRENS (*Ber. Landw. Vers. Anst. Augustenb., 1905, pp. 34–41*).—A comparison was made of martellin and other potash salts as fertilizers for tobacco. No increase in the yield of leaf which might have been attributed to the use of the fertilizers was secured. The different forms of potash also were almost without influence upon the quality in this test with the exception of the sulphate, which seemed to have reduced the quality slightly. High topping of plants seemed to favor the quality of the leaf.

In a second fertilizer experiment the influence of different fertilizer treatment was studied. Tobacco receiving no potash in the fertilizer showed the lowest potash content, but did not rank lowest in burning quality. The leaf with a high potash content ranked lower in burning quality than the produce which contained less potash.

These results are interpreted as meaning that the potash content is not alone, nor even predominant, in controlling the burning quality. The tobacco grown on the check plat which received no fertilizer treatment stood lowest in ash, but not in potash. The highest ash content was secured on a plat receiving potash, phosphoric acid, and nitrogen, followed by the plats receiving potash and nitrogen, and potash, phosphoric acid, nitrogen, and lime. The burning quality of the leaf did not seem to increase with the content of potassium carbonate.

Species of tobacco, their phylogeny, quality, and uses, O. COMES (*Naples: 1905, pp. 231, figs. 68; abs. in Bot. Centbl., 102 (1906), No. 36, pp. 268–270*).—The great variability in the different species of tobacco due to various causes is discussed, their history, geography, and statistics are given, and the importance of new phylogeny of every species and strain, in connection with the improvement of the crop, is pointed out. It is stated that individuals originating from the same plant are early in maturing when grown from the grains which ripen earliest on the mother plant, while the individuals from the later maturing seed are likely to be late in maturing.

The form *Nicotiana tabacum havanensis* introduced into a strain by breeding gives aroma to the product, while the form Brasiliensis increases leaf production.

Characters determining the quality of wheat, A. CSERHÁTI (*Ztschr. Landw. Versuchsw. Österr., 9 (1906), No. 10, pp. 899–972*).—The results of experiments with different varieties of wheat are reported and data with reference to the weight per hectoliter, weight per thousand kernels, mealiness or softness, and protein and gluten content in their relation to quality are tabulated. It is concluded that the quality of wheat can not be determined by means of the different characters which were studied, and that the only definite way of judging wheats is by their milling products.

It is stated that the weight per hectoliter is a valuable factor only when the wheats compared are of the same variety and were grown in the same locality. It is known that the same wheat varieties grown under the same environment yield more flour when their weight per hectoliter is high, but when the wheats are not of the same variety or have been grown in different regions no reliance can be placed upon this character in judging the flour content.

The weight per thousand kernels, which is referred to as the absolute weight, was found to vary considerably. A normally developed wheat has an absolute weight of 25 to 55 gm. Foreign varieties grown in these experiments, which produced flour of an inferior quality, were higher in absolute weight than the Hungarian sorts. The domestic varieties as a rule weighed less than 40 gm., while the foreign wheats in nearly all cases weighed over 40 gm. per hundred

kernels. It is pointed out that this result does not necessarily indicate that wheat is better in quality on account of its low absolute weight.

The absolute weight and mealiness were correlated to some extent, wheats with a high absolute weight also ranking high in mealiness, and those low in absolute weight standing low in mealiness. Although this was generally the case, in many instances wheats grown in the same region were found to be exceptions to this rule. The absolute weight and the protein content of the material under investigation were inversely proportional to each other, but attention is called to the fact that this can not be a definite rule, because the protein content of varieties of the same absolute weight may vary considerably in different seasons. The correlation between the absolute weight and the gluten content was less evident than between absolute weight and protein.

In quality the mealy or soft wheats were inferior to the hard glassy varieties. The increase in mealiness of the grain was generally accompanied by a decrease in protein and gluten, but in a few instances this was not the case.

Protein content and quality are correlated in that wheats high in protein are usually superior in quality. The average results of the different analyses reported indicate that with a few exceptions the gluten content increased with the protein content. It was observed that the quality of the gluten and not its quantity determined the quality of the wheat.

HORTICULTURE.

Horticulture department, R. W. Fisher (*Montana Sta. Rpt. 1905, pp. 281–284*).—This gives a brief outline of the work of the year, with some details in regard to thinning experiments with apples.

In one case with Duchess and Wealthy trees ranging from 8 to 15 years old about ⅗ of the crop, or an average of 918 apples, was taken from each tree. It required 15 minutes to thin the fruit from one Duchess tree and 22 minutes from each Wealthy tree, the trees in the latter case being larger and with a heavier crop of smaller fruit. At these rates it is figured that it would cost $7 to thin an acre of Duchess trees and $9.60 an acre of Wealthies. In some other experiments it required 9 minutes to thin fruit on McIntosh trees planted 18 ft. apart each way. For thinning Alexander trees 14 minutes was required. In all cases marked benefit in the increased size of the apples as the result of the thinning was noted.

Report of the horticulturist, F. Garcia (*New Mexico Sta. Rpt. 1905, pp. 27–31*).—A general outline of the work of the year, with some details of the cost of producing chiles. The cost per acre of preparing the land, sowing the seed, irrigating, hoeing, cultivating, etc., for green chiles was $15.82, seed $4, picking $12.78, hauling to cannery $4.50, making a total cost of $37.10 per acre. The yield was 7,536 lbs., which sold at the cannery for 1½ cts. a pound, leaving a net profit for this crop of $75.94. For red chiles the cost of production was $43.04 per acre and the net profit $116.26.

The Casaba melon, C. C. Royce (*Pacific Rural Press, 72 (1906), No. 20, p. 308*).—Letters from this Department are quoted, showing that seed of the Casaba melon was sent to parties in California as early as 1869.

Dwarf fruit trees, F. A. Waugh (*New York: Orange Judd Co., 1906, pp. 125, figs. 44*).—A popular account for amateur fruit growers of the propagation, pruning, and the general management of dwarf fruit trees in the United States and Canada is given.

It is believed that dwarf fruits, while of but little commercial importance in this country, may find a place in the gardens and small grounds of people living

in cities and towns. Some of the advantages of the dwarf trees are the early bearing habit, small size, high quality of the fruit, suitability for suburban places, as orchard fillers and as illustrative material for school gardens, and for covering walls and fences. Among the disadvantages are the greater expense of the trees, greater care required in their management, and their shorter life.

Fruits for the Hawaiian Islands, W. T. Brigham (*Hawaii. Forester and Agr., 3 (1906), No. 10, pp. 289–311, figs. 2*).—In a paper read before the Farmers' Institute of Hawaii brief mention was made of about 100 tropical and subtropical fruits that either have been or should be cultivated in the Hawaiian Islands. The paper is followed by a brief discussion.

Suggestions on the renewal of the peach industry in New Jersey, G. F. Warren (*New Jersey Stas. Bul. 197, pp. 46, figs. 19*).—During the period between 1890 and 1900 it appears that the number of peach trees in New Jersey decreased 38 per cent, due chiefly to the work of the San José scale but also to poor tillage and other causes. The present bulletin shows the adaptability of different portions of the State to the peach industry and encourages increased planting.

Directions are given for the culture of peaches from planting to marketing, together with results of experiments in planting different kinds of pits, pruning the tops to different degrees at transplanting time, dipping with lime, salt and sulphur mixture, and determining the amount of plant-food removed by a 10-year-old peach tree during its growth.

It appears that about three-fourths of the peach trees of the State are situated on the brownish-yellow, chestnut soils of the hills and mountains of North Jersey. Second in importance to this soil are the gravelly loams of South Jersey. Good peaches are also grown on the sandy trucking soils of the State.

Out of 620 pits of natural seedlings planted 108 trees were secured, while from 321 pits from budded trees only 7 trees were secured, indicating that in nursery work the pits of seedlings are best for growing stocks. One-year-old trees proved better than June-budded trees for transplanting in the orchard. When trees were dug and the roots exposed to the sun for 15 minutes to 1¾ hours before planting the number of trees making a good growth was decreased from 33 to 66 per cent. If the trees must be planted when the ground is not moist it is advised that the roots be dipped into water before planting.

Owing to the wide spread of the San José scale it is advised that the tops of the trees be dipped in a lime, sulphur and salt solution before planting. Experiments were made in dipping trees in single and double strength solution, which showed that no injury results unless the buds have started into growth, in which case the buds are killed. If root lice are present the roots of the trees should also be dipped. The trees should be examined for borers and those found dug out. Measurement of the growth of twigs at different periods during the season indicated that about half the growth was completed by the middle of May and about four-fifths by the middle of June, showing that cultivation for the purpose of benefiting the tree should be done early in the season, commencing before the time corn is planted.

The total weight of the wood, prunings, roots, leaves, and fruit produced by a peach tree during 10 years' growth was found to be 616 lbs., of which about 2.8 lbs. was nitrogen, 0.76 lb. phosphoric acid, and 1.7 lbs. potash. It is calculated on this basis that an acre of trees set 16 by 15 ft. would utilize 516 lbs. of nitrogen, 838 lbs. of phosphoric acid, and 307 lbs. of potash in 10 years. The average per acre for the first 4 years would be 33 lbs. of nitrogen, 8 lbs. of phosphoric acid, 18 lbs. of potash, and for the last 6 years 64 lbs. nitrogen,

18 lbs. phosphoric acid, and 40 lbs. potash. The results here given are compared with like data secured at the New York Experiment Station and in Germany and correspond fairly well except in the matter of potash, which was slightly more than half of that reported by other investigators, due to the fact that the tree had produced only a comparatively small amount of fruit. It is stated that before an orchard of peaches is set out in New Jersey the soils in nearly all cases should be limed with 25 to 40 bu. per acre.

Trees at transplanting time were pruned to whips, 1 in. stubs, and 3 in. stubs, and by leaving two-thirds of the top. The trees pruned to whips at the time of planting, 1 in. stubs or 3 in. stubs, did equally well and made better and larger trees by fall than those on which two-thirds of the top was left.

The chief varieties grown in the State appear to be first Elberta, then Reeves Favorite, Mountain Rose, and Chair Choice.

Pruning peach trees, F. Horsfall (*Missouri Fruit Sta. Circ. 2, pp. 4*).—Popular directions for pruning peach trees are given.

Culture of the olive, L. Degrully (*Ann. École Nat. Agr. Montpellier, n. ser., 6 (1906), No. 2, pp. 90–160, figs. 15*).—An extensive account of the propagation and culture of olives.

Growth and ripening of persimmons, W. D. Bigelow, H. C. Gore, and B. J. Howard (*Jour. Amer. Chem. Soc., 28 (1906), No. 6, pp. 688–703, figs. 4, dgms. 4*).—The text is given of a paper presented at the New Orleans meeting of the American Chemical Society held December 30, 1905, an abstract of which has already appeared (E. S. R., 17, p. 612). The paper has been reprinted as a separate.

Production and commerce of bananas and pineapples in Western French Africa, Y. Henry (*Agr. Prat. Pays Chauds, 6 (1906), No. 43, pp. 284–295*).—An account of the suitability of French Guinea for the production of bananas and pineapples, with suggestions on shipping and marketing. Because of the low land values, cheap labor, and cheap water for irrigation, it is believed the country is specially favorable for the production of these tropical fruits.

Culture and commerce of the banana in Costa Rica, Jores (*Agr. Prat. Pays Chauds, 6 (1906), No. 43, pp. 298–303, fig. 1*).—The yearly production of bananas in Costa Rica is placed at 6,000,000 bunches, valued at $1,160,000. The present article deals with the recent efforts of the government of Costa Rica and the United Fruit Company to develop this industry in the islands. The cost of production is placed at about 10 cts. per bunch.

Analysis of pineapples, G. A. Cuadrado (*Bol. Ofic. Sec. Agr. Cuba, 1 (1906), No. 6, pp. 427–434*).—The results secured in the analysis of pineapples are given, with an account of the chemical methods employed in making the analysis.

New wax article (*Mo. Consular and Trade Rpts. [U. S.], 1906, No. 313, pp. 109, 110*).—An account is given of the wax obtained from rafia palm, the same palm from which is gathered rafia fiber.

The wax is a by-product obtained in the production of the fiber, and has about three-fifths the value of the fiber. In one experiment 104 kg. of leaves gave 0.78 lb. of prepared wax. It is estimated that the average wax production would be about 100 gm. for every kilogram of rafia obtained. It is believed the wax will have a commercial value about equal to that of beeswax.

European grapes, F. Garcia (*New Mexico Sta. Bul. 58, pp. 32, figs. 6*).—Notes are given on tests of 52 varieties of European grapes, with brief descriptions of the same and directions for the culture of grapes in New Mexico. A discussion on the crown gall diseases of the grapevine, by G. G. Hedgcock, of the Bureau of Plant Industry, is included.

The European or Vinifera grapes appear to be well adapted to culture in the Rio Grande Valley, where native or American grapes are but little grown. The Mission is the variety generally grown, but both earlier and later varieties are desirable for prolonging the season. The Chasselas group of grapes appears to be quite resistant to the crown gall, which is a prevalent disease there.

From tests at the station it appears that a rather light soil is preferable to heavy adobe for European grapes. As a protection against winterkilling the vine should be hilled in the fall. Irrigating the hilled vine during the winter was not found to be detrimental. From 4 to 6 irrigations in summer were sufficient to mature a crop.

Wild plant improvement, N. B. PIERCE (*Pacific Rural Press, 72 (1906), No. 19, pp. 292, 293*).—The author states that while there are 895 experiment stations and agricultural colleges and 252 important botanic gardens and arboreta now in the world, not one has been founded for or specifically devoted to the improvement of wild plants. It is believed that there is a large field for useful work in this direction, and in substantiation of this statement the work that might be undertaken with various species of cotton, grapes, figs, persimmons, olives, raspberries and blackberries, chestnuts and walnuts, clovers, millet, grasses, and the various grains, vegetables, flowers, and timber trees is suggested.

All the hollies worth growing, W. MILLER (*Gard. Mag.* [N. Y.], *4 (1906), No. 5, pp. 234–237, figs. 10*).—This article sets forth the horticultural value of the various species of ilex, including the red-berried evergreens, the red-berried deciduous species, the scarlet-orange group, and the black-berried group. Cultural directions are given for the various hollies, with a planters' guide to the species.

Lawns and how to make them, L. BARRON (*New York: Doubleday, Page & Co., 1906, pp. 174, pls. 31*).—This book contains very full directions for the making of large and small lawns, renewing old lawns, fertilizing, grading, and general care of lawns, with accounts of the different species of grasses used for lawns and lawn mixtures, and of the machinery and tools used in the making and caring for lawns.

In the final chapter a tabular presentation is given, showing the essential differences in regard to soil requirements, character and uses, prices, weights, quantities to sow, etc., of 17 standard lawn grasses.

Pot fertilizer experiments with roses, F. WEBER (*Gartenflora, 55 (1906), No. 20, pp. 529–533*).—A fertilizer experiment was carried out with the variety Frau Karl Druschki, in which one pot was used as a control, one fertilized with pigeon manure dissolved in water in the proportion of 1 : 24, each pot receiving about 0.2 of a liter per week; one the same manure in the same proportion and amount per plant plus 3 gm. of sulphate of ammonia, and a fourth fertilized with 2 gm. of nitrate of soda, 1 gm. double superphosphate, and 2 gm. of chlorid of potash, all dissolved in 1 liter of water and applied at the rate of 0.2 of a liter per pot weekly.

The work was carried on at 5 different experiment stations and the results as regards growth, resistance to disease, and the production of flowers recorded for each station. Generally speaking, the smallest growth was made in the control pot. At 3 of the 5 stations the plants fertilized with minerals alone were most resistant to disease and insect attacks, while the average of the results secured at all of the stations showed that the minerals alone produced from 2 to 6 per cent more flowers than were obtained in any of the other pots.

Further development of etherization in the forcing of lilacs, F. LEDIEN (*Möller's Deut. Gärt. Ztg., 21 (1906), No. 44, pp. 530–534, figs. 4*).—An account

of the development of etherization in the forcing of lilacs in Germany is given, with the results of recent experiments by the author.

With the variety Marie Legraye it was observed that by the end of July the flower buds had already formed. When the plants were defoliated at this time and brought in a close, moist, warm air, they blossomed within 4 weeks without etherization. The plants did not blossom any sooner than this when etherized either before or after defoliation, neither did the plants produce bloom when brought into a warm, moist atmosphere unless they were first defoliated. When the plants were defoliated and left in the open, even in warm weather, they did not produce flowers. A moist temperature, as well as a warm one, seemed to be an essential condition of their blooming. It is believed that these observations make an important supplement to the theory of Johannsen on the degree of maturity and rest period of plants.

With the variety Charles X the flower buds did not develop so early nor did they respond when the plant was defoliated in a warm, moist atmosphere, as was the case with Marie Legraye. When this variety was defoliated and etherized July 27, a large number of the uppermost buds were killed, though many leaves were sent out from the lower buds. When etherized with 40 gm. of ether per hectoliter of space, with the leaves on, it produced several well expanded flower clusters 4 weeks later. With Charles X, as with the Marie Legraye, plants neither defoliated nor etherized did not produce flowers even though kept in a warm, moist atmosphere.

The results show that with Marie Legraye it is possible to have flowers from the beginning of August on, and with Charles X from about the first of September. At this time about 40 gm. of ether per 100 liters space can be safely used with the latter variety.

Epsom salts for azaleas, J. C. Hogenson (*Gard. Mag.* [N. Y.], *4 (1906), No. 5, p. 228, figs. 3*).—The author successfully grew azaleas in soils well supplied with lime by the use of sulphate of magnesia to counteract the lime.

In the experiment here reported 2 plants as nearly alike as possible were potted separately in a compost to which nearly a half ounce of lime was added to every 5 lbs. of soil. To one of the pots there was added in addition a quarter of an ounce of sulphate of magnesia to every pound of soil. The flower buds of the plant in the pot to which no sulphate of magnesia was added made a poor development, and finally turned brown and dried up without opening at all, while in the pot in which the sulphate of magnesia was added the plant made a good, vigorous growth and bore and abundance of flowers. Like results were also secured with rhododendrons.

FORESTRY.

Forest planting on coal lands in western Pennsylvania, S. N. Spring (*U. S. Dept. Agr., Forest Serv. Circ. 41, pp. 16*).—A brief history is given of the original forest conditions of the coal lands in Pennsylvania, with an account of the development of coal mining and its effects on agriculture and forestry in the mining district. The injurious effects on all vegetation of coke production, due to sulphur gas, is briefly mentioned and the opportunity for forest planting on these lands discussed at considerable length.

A planting plan covering 456 acres was made for lands in this area and is given in detail. The plan, it is believed, will be generally applicable to the Connellsville basin in Pennsylvania. The chief trees recommended are red oak, chestnut, white oak, European larch, yellow poplar, hard maple, and hardy catalpa. The plan provides for the growing of nursery trees for restocking

this area. The total outlay per acre for forest planting is placed at approximately $10.

Special attention is called to insects as obstacles to planting in western Pennsylvania, the more serious of these being a measuring worm and certain insects especially injurious to locust trees.

The utilization of tupelo, H. B. Holroyd (*U. S. Dept. Agr., Forest Serv. Circ. 40, pp. 16, figs. 4*).—An account is given of the range and distribution of this wood, its uses, methods of logging and milling, the air and kiln-drying. With increasing knowledge as to the best methods of handling this timber has come an extension of the uses to which it is put. In 1905 it is estimated that 40,000,000 ft. of this lumber was cut.

The dry wood weighs about 32 lbs. per cubic foot and the shipping weight varies from 3,000 to 3,500 lbs. per thousand feet. The wood is strong, stiff, tough, and hard to split, but easy to work with tools. It takes glue, paint, or varnish well, absorbing but little of the material. The better grades of the wood are extensively used in England for interior finish and flooring.

Tupelo is much used in this country in the manufacture of boxes, laths, pumps, violin and organ sounding boards, drawers, panels, etc. It promises to be especially useful for tramways and as flooring for depots, warehouses, and other places subject to heavy traffic. As it takes preservatives well it is thought it may find use as cross-ties, street paving, and cross-arms.

Special care must be taken in piling tupelo. The front foundation of the pile should be at least 2½ ft. high and have a slope of 1 in. for each foot of length. The best results have been obtained by making the pile 6 ft. in width and not over 16 or 17 ft. high. Cross strips should be made of thoroughly dry material, 1¼ to 2 in. wide and 1 in. thick. An 18-ft. pile should contain 7 of these strips, a 16-ft. pile 6, a 14-ft. pile 5, and a 12-ft. pile 4. The boards should be laid 2½ to 3 in. apart. Between the top of the pile and the roof a space of about 6 in. should be left to admit plenty of air. The roof should extend a foot or two beyond each end of the pile and should be so constructed as to exclude the rain. At least 18 in. should be left between piles.

Experiments show that tupelo can be kiln-dried by the same methods and with the same success as red gum. "The lumber should enter a temperature of about 93° F. at the wet end of the kiln. The temperature gradually increases as the truck moves toward the dry end, where it should stand in a temperature of from 140° F. to 150° F. for 2 or 3 days." The lumber on the kiln truck should be so piled as to leave continuous open spaces in order to give an upward vent and aid the circulation. Tupelo lumber kiln-dried 15 days came out without molding, staining, or stick rotting. The loss in weight was about 33 per cent and the shrinkage in board measure 4.4 per cent.

Grades and amount of lumber sawed from yellow poplar, yellow birch, sugar maple, and beech, E. A. Braniff (*U. S. Dept. Agr., Forest Serv. Bul. 73, pp. 30*).—An endeavor was made to determine in typical localities and under good conditions of manufacture the graded yield and money value of yellow poplar, yellow birch, sugar maple, and beech.

The graded yield of yellow poplar was made in both Virginia and Tennessee, and of birch, sugar maple, and beech in the Adirondack hardwoods. In this work the saw crews were followed, the trees and individual logs in the trees measured and marked as they were felled, and the amount and grade of lumber produced by each log determined at the mill. In the case of yellow poplar 5,735 logs from 1,407 trees were thus traced through a Tennessee mill and the logs from 315 trees through a Virginia sawmill. The yield of firsts and seconds, saps, box boards, commons, and shipping and mill culls is shown in tables for

trees of different diameters ranging from 13 to 70 in., as is also the money value of the trees and the value of the lumber per 1,000 ft. Based on this work a log rule is given for southern hardwoods and the method of using in timber cruising the data obtained is described.

In the study of Adirondack hardwood the inner portion of each 8-ft. log and each 16-ft. log was put into ties, the rest of the log being manufactured into lumber. Twelve and 14-ft. logs were made entirely into lumber. The graded lumber sawed from each of the different species is given in tabular form for trees of different diameters ranging from 13 to 31 in. and the results discussed in detail. The better grades of yellow birch are shown to increase from 13 per cent in a 13-in. tree to 58 per cent in a 31-in. tree, while the poorer grades drop from 86 to 40 per cent between the same diameters.

In a discussion of the profits from Adirondack lumbering it is shown that if all birch and maple were cut down to and including 19 in. diameters the profits per acre would be $8.14, of which $7.48 would be from birch and 66 cts. from maple. Beech would not pay expenses. It is stated that "hardwood lumbering in the Adirondacks is so expensive that as a rule it does not pay to cut any but the larger trees for lumber."

Cross ties purchased by the steam railroads of the United States in 1905, H. M. HALE (*U. S. Dept. Agr., Forest Serv. Circ. 43, pp. 6*).—Replies from 770 steam railroad companies, representing about 285,000 miles of track, are given, showing the number of cross ties used in 1905.

The total number reported is 77,981,227, of which 18.5 per cent were for use in the construction of new track and the remainder for renewals. Of the total number 44.5 per cent are made from oak and 23.5 per cent from pine. Standing next in importance to these species are cedar, representing about 7 per cent, and chestnut, about 5 per cent. Practically the only region in the United States where ties are produced as a major product of the forest is on the Pacific coast. In the east the farmer's woodlot is the chief source of supply.

Nearly 10 per cent of the ties purchased in 1905 were treated with preservatives. In the southern, lake, and central regions more hewed than sawed ties are used, but on the Pacific coast 82.3 per cent of the ties are sawed.

Experiments on the strength of treated timber, W. K. HATT (*U. S. Dept. Agr., Forest Serv. Circ. 39, pp. 31, figs. 2*).—A summary is given of the results secured in an extensive study of methods of the influence of preservative processes upon the strength of woods. The preservatives used were creosote and zinc chlorid. Both green and seasoned timbers were treated in a high-pressure impregnating cylinder. The timbers used were loblolly and western yellow pine railroad ties 11 ft. long. The following conclusions from the work are drawn:

"(1) A high degree of steaming is injurious to wood. The degree of steaming at which pronounced harm results will depend upon the quality of the wood and its degree of seasoning, and upon the pressure (temperature) of steam and the duration of its application. For loblolly pine the limit of safety is certainly 30 pounds for 4 hours, or 20 pounds for 6 hours. (2) The presence of zinc chlorid will not weaken wood under static loading, although the indications are that the wood becomes brittle under impact. (3) The presence of creosote will not weaken wood of itself. Since apparently it is present only in the openings of the cells, and does not get into the cell walls, its action can only be to retard the seasoning of the wood."

Transverse strength of clanwilliam cedar (*Agr. Jour. Cape Good Hope, 29 (1906), No. 4, p. 448*).—Tabular results are given of the tests of a number of beams cut from dry trees of clanwilliam cedar.

Black wattle forestry in South Africa, W. HOLTZ (*Ber. Land u. Forstw. Deutsch-Ostafrika, 3 (1906), No. 1, pp. 14, pls. 3*).—A report is here given of the black wattle industry of South Africa, with an account of the culture, commercial importance, and uses of the forests.

Consumption of tanbark in 1905, H. M. HALE (*U. S. Dept. Agr., Forest Serv. Circ. 42, pp. 4*).—Statistics from 222 firms operating 477 tanneries were obtained, showing the consumption of tanbark in the United States in 1905.

The total amount of bark used during the year is placed at 1,104,045 cords, of which 73 per cent was hemlock and 27 per cent oak. The average price of the hemlock bark per cord was $6.32 and of the oak bark $10.44. Pennsylvania produced the largest amount of bark, 428,709 cords, followed by Michigan with 240,653 cords.

Other data show that the extract of quebracho, a tanning product obtained from a South American tree, has greatly increased during the last few years, amounting approximately to 87,000,000 lbs. in 1905, valued at $2,480,000.

Wood used for pulp in 1905, H. M. HALE (*U. S. Dept. Agr., Forest Serv. Circ. 44, pp. 11*).—A report is made of the quantity and value of wood used for pulp manufacture in 1905.

The wood used for pulp amounts to about 4 per cent of the amount used annually for lumber. In 1905 there were 164 companies operating 237 mills. These used 3,192,223 cords of wood, from which was produced 2,084,482 tons of pulp. The amount of pulp produced from a cord of wood by different methods of manufacture was as follows: Mechanical 2,372 lbs., soda 1,033 lbs., and sulphite 1,009 lbs.

The wood most commonly used for pulp is spruce which in 1905 constituted more than 70 per cent of the total. Next to spruce stands poplar, followed by hemlock, pine, balsam, cottonwood, etc. Most of the wood in 1905 was reduced by the sulphate process, the proportions being sulphite 51 per cent, mechanical 34 per cent, soda 15 per cent. The amount of spruce and poplar imported in 1905 for pulp making was 645,428 cords. New York State leads in the production of pulp and in the importation of wood for this purpose.

The use of slabs for pulp making is reported by 138 establishments. It seldom constitutes, however, more than 10 per cent of the total amount of wood used by a single mill. About 85 per cent of the companies reporting carry on logging operations and only 5 companies depend wholly upon other states or Canada for their supply of wood. The average price of wood f. o. b. at the point of shipment is $5.55.

The cultivation of Ficus elastica, the India rubber of the east, C. BALD (*Calcutta: Thacker, Spink & Co., 1906, pp. V + 32, pls. 4*).—*Ficus elastica* is considered the most promising species for cultivation in Ceylon. The present work is intended as a guide to those contemplating the establishment of rubber plantations and deals with soil, rainfall, elevation, planting, cultivation, etc.

DISEASES OF PLANTS.

A new anthracnose of alfalfa and red clover, S. M. BAIN and S. H. ESSARY (*Jour. Mycol., 12 (1906), No. 85, pp. 192, 193*).—In a preliminary note on clover diseases (E. S. R., 17, p. 567) the authors announced the discovery of a new clover disease in Tennessee caused by an undescribed species of Colletotrichum. Experiments are being carried on to determine the life history of the fungus, as well as breeding experiments with clover to secure resistance to the disease, and pending publication on these experiments the authors thought best to give a description of the species.

Since the publication of the preliminary note on this disease, opportunity has been offered to compare notes and specimens of a similar disease of alfalfa, and so far as the authors' observations go the fungi occurring on clover and alfalfa are identical. On both clover and alfalfa considerable injury is reported, and in the clover fields of Tennessee this disease appears to be the most destructive fungus disease known.

There appear to be in the case of clover 2 critical periods when the plant is especially subject to the disease. The first is when the seedlings encounter the first prolonged hot spell during summer, at which time the disease attacks the petioles. This appears to be the period of greatest injury. The other period of especial susceptibility is during the ripening of the seed, when the severest attacks are observed on the stems just at or slightly below the surface of the ground. Many flower heads are destroyed by attacks just below them, the host plant as a whole appearing usually to survive. The statements given are general in character and more detailed descriptions will be given later.

The name *Colletotrichum trifolii* n. sp. has been given the fungus, a technical description of which is appended.

Indian wheat rusts, E. J. BUTLER and J. M. HAYMAN (*Mem. Dept. Agr. India, Bot. Ser., 1 (1906), No. 2, pp. 1–52, pls. 5*).—According to the authors' investigation 3 distinct species of rust are prevalent in India, black rust (*Puccinia graminis*), yellow rust (*P. glumarum*), and orange rust (*P. triticina*), all three of these species attacking wheat, while barley is subject to attacks of the first 2 species.

In different districts of India the different species found on wheat vary, *P. triticina* being the most common in eastern districts, *P. graminis* in southern, and *P. glumarum* in the northern part. The only intermediate hosts for any of these rusts known in India are the barberries near Simla, which bear the aecidia of *P. graminis*.

In India oats are not attacked by the black rust of wheat or barley, the particular physiological race of *P. graminis* which attacks oats apparently not having been introduced.

Studies were made of these different rusts, their distribution, relationship, host plants, etc., and from the data obtained it is believed that it would be possible to begin investigations on the production of resistant varieties of wheat on a rational plan. It is shown that in these breeding experiments the resistance to different species will have to be considered separately, since resistance to one particular rust does not imply resistance to others.

Flower infection by smuts, O. BREFELD and R. FALCK (*Untersuch. Gesam. Geb. Mykol., 1905, No. 13; abs. in Bot. Centbl., 101 (1906), No. 8, pp. 212, 213*).—As a result of prolonged experiments the authors have determined the means of smut infection and dissemination in the case of a number of species.

Infection experiments with loose smut of wheat show that the infection takes place in the flowers and not when the plant is in the seedling stage. The same is true for barley smut, and seed treatment for the prevention of these diseases is worthless. To combat these diseases selected seed from crops that are free from disease is the only practical means, and the seeds should be sown upon smut-free soils.

With oats there seems to be evidence of abundant infection during the seedling stages, and this is also the case with the millet smuts and some other species.

Previous investigations show the infection of corn by means of aerial conidia produced from smut masses in freshly manured soils (E. S. R., 7, p. 693).

Combating the stinking smut of wheat and rye, A. VOLKART (*Landw.*

Jahrb. Schweiz, 20 (1906), No. 8, pp. 445–490, figs. 3).—An extended account is given of experiments in treating seed wheat and rye with various fungicides for the prevention of the stinking smut. The fungicides tested were copper sulphate, Ceres powder, hot water, Bordeaux mixture, soda Bordeaux mixture, and formalin. The effect of these different solutions on the germination of the seed and their efficiency in preventing the smut are described at length.

In conclusion the author states that while all the treatments are more or less efficient, yet for general purposes the use of a solution of formalin is to be preferred.

The relation of the weather to rust of cereals, W. H. MORELAND (*Mem. Dept. Agr. India, Bot. Ser., 1 (1906), No. 2, pp. 53–58, dgm. 1*).—The author has compiled data to show the influence of the character of the season on the rust of cereals; the amount of rain in October, which determines the wetness of the seed bed; the average humidity of January and February, and the average of January and February taken together.

It was found that the amount of October rainfall has no influence on determining the amount of rust on wheat. Where harvest is earliest the extent of rust varies with the humidity during January. Elsewhere the rust varies generally with the humidity of the months of January and February taken together.

The occurrence of a case in which barley was badly rusted while wheat was free from it will require some explanation other than weather relations.

Investigations on the disease of rice called brusone, U. BRIZI (*Ann. Ist. Agr. [Milan], 5 (1901–1904), pp. 77–95*).—After briefly reviewing the various reputed causes of brusone of rice the author gives an account of experiments carried on with this disease. While he is not able to say definitely what are the causes of the disease, yet from his investigations he concludes that it is primarily due to some functional disturbance of the root system of the plants and is not caused by fungi or other parasites. It seems possible so to disturb the normal activities of the plant as to make it readily attacked by different fungi, but the disease can originate independently of all parasitic attacks.

Some fungus diseases of corn, L. H. PAMMEL (*Iowa Agr., 7 (1906), No. 2, pp. 47–50*).—Popular descriptions are given of corn rust, bacteriosis, corn wilt, and leaf browning.

Recent investigations on potato and tomato diseases, O. APPEL (*Jahresber. Ver. Vertreter Angew. Bot., 3 (1904–5), pp. 122–136, figs. 2*).—Notes are given of recent observations on a number of diseases of potatoes. Among them are the speck rot of tubers due to *Stysanus stemonitis*, a disease attributed to *Spondylocladium atrovirens*, injury due to mites, a Fusarium disease, the rot caused by *Phytophthora infestans*, a leaf rolling disease caused by a Fusarium that is said to be similar to but not identical with *F. oxysporum* (E. S. R., 15, p. 1088), a bacterial disease of potatoes, and black shank of potatoes.

The early and late blight of potatoes and how to combat them, W. J. GREEN and C. W. WAID (*Ohio Sta. Circ. 58, pp. 4*).—Descriptions are given of the early and late blight of potatoes and suggestions for their prevention. The circular is issued in advance of a bulletin on the same subject.

Fungus diseases of sugar cane in Bengal, E. J. BUTLER (*Mem. Dept. Agr. India, Bot. Ser., 1 (1906), No. 3, pp. 53, pls. 11*).—A preliminary report is given of the principal fungus diseases which affect sugar cane in Bengal. The cause and characters of the different diseases are briefly described and recommendations made for combating them so far as means are known.

The diseases described are red rot or red smut (*Colletotrichum falcatum*), smut (*Ustilago sacchari*), *Diplodia cacaoicola*, *Cytospora sacchari*, pineapple disease (*Thielaviopsis ethaceticus*), black rot (*Sphæronæma adiposum*), brown

leaf spot (*Cercospora longipes*), ring spot (*Leptosphæria sacchari*), and sooty mold (*Capnodium* sp.). Of these diseases the red rot or red smut is by far the most destructive. The author believes this disease is carried in the majority of cases by cane cuttings that are planted. The selection of sound cane and of resistant varieties, the destruction of diseased material, and the avoiding of ratooning are recommended as possible means of control.

In addition to the above, brief notes are given on a number of other diseases that are not common or are as yet unreported from Bengal, although probably existing there or liable to introduction.

Gumming of the sugar cane, N. A. Cobb (*Hawaii. Planters' Mo., 25 (1906), Nos. 1, pp. 13–36, figs. 10; 2, pp. 57–68, figs. 2*).—This is a reprint of Hawaiian Sugar Planters' Station, Division of Pathology and Physiology Bulletin 3 (E. S. R., 17, p. 778).

Preliminary notes on root diseases of sugar cane in Hawaii, L. L. Brain (*Hawaii. Planters' Mo., 25 (1906), Nos. 3, pp. 104–121, figs. 11; 4, pp. 153–166, fig. 1*).—This is a reprint of Hawaiian Sugar Planters' Station, Division of Pathology and Physiology Bulletin 2 (E. S. R., 17, p. 778).

Pear blight, F. M. Rolfs (*Missouri Fruit Sta. Circ. 3, pp. 4*).—Attention is called to the bacterial blight of pears. The life history of the organism and mode of infection are described and methods of treatment suggested.

The use of Bordeaux mixture for the control of Cycloconium on the olive, O. Tobler and U. Rossi-Ferrini (*Atti R. Accad. Econ. Agr. Georg. Firenze, 5. ser., 3 (1906), No. 3a, pp. 327–337*).—The results of a series of experiments in spraying olive trees for the prevention of attacks of *Cycloconium oleaginum* are given, which show that while in general the appearance of the tree is improved by the use of the fungicide, yet marked differences are to be noted in the effect on the yield of different varieties. The experiments cover a period of 3 years with a number of varieties, and the results are tabulated.

Treatment for fumagine of olive, D. Vidal (*Prog. Agr. et Vit. (Ed. l'Est), 27 (1906), No. 43, pp. 509–515*).—An account is given of experiments that have been carried over a number of years for the prevention of fumagine of olives, and the author states that the most efficient treatment is one that is directed against both the fungus and the insect which it follows.

Spraying the trees with Bordeaux mixture to which either turpentine or a resin soap mixture was added gave splendid results. Where a tobacco decoction was added to the Bordeaux mixture the results obtained were less favorable.

In general, a Bordeaux mixture containing 2 per cent copper sulphate is preferred, and the turpentine may be poured into the preparation, after which it is to be vigorously stirred. The annual or biennial pruning of the trees facilitates the preventive treatment, and it is thought that by continuing it for 5 or 6 years olive orchards could be cleared of these pests.

Notes on gooseberry mildews, E. S. Salmon (*Gard. Chron., 3. ser., 40 (1906), No. 1035, p. 294*).—The occurrence of the European gooseberry mildew (*Microsphæra grossulariæ*) on red currants is noted, this fungus having heretofore been reported in Europe as attacking only gooseberries. Attention is also called to the fact that the American gooseberry mildew (*Sphærotheca mors-uvæ*) has been reported during the present season as occurring on red currants in Ireland and in Denmark.

For the prevention of injury by these fungi spraying with potassium sulphid is recommended.

American mildew in Sweden (*Gard. Chron., 3. ser., 40 (1906), No. 1033, p. 262*).—An account is given of means which have been adopted in Sweden to exterminate the gooseberry mildew (*Sphærotheca mors-uvæ*). The minister of

agriculture has granted a sum of about $2,250 toward the publication in newspapers of a full description of the disease, with instructions for ridding gardens of this pest.

It is recommended that all infected bushes be dug up and burned and to prevent the spread of the mildew by spraying the bushes with a strong mixture of sulphur. The importation, transplanting, or sale of gooseberry bushes is prohibited until the end of the year 1907. Growers will be compensated for the loss of stock, preference being given those who have cultivated them for nursery purposes.

Attention is called to the fact that this fungus occurs on related species, particularly on some of the currants, and in one instance it is said that the fungus has been found on raspberries.

The American gooseberry mildew in 1906, E. S. SALMON (*Gard. Chron., 3. ser., 40 (1906), No. 1036, pp. 301, 302*).—A warning is given to English gooseberry growers of the danger of introduction of the American gooseberry mildew (*Sphærotheca mors-uvæ*), which is reported as being very prevalent in parts of Ireland.

Attention is also called to the occurrence of this fungus in Germany and Sweden, and the means that are taken to combat its spread.

A disease of grape stocks, P. MAGNUS (*Ber. Deut. Bot. Gesell., 24 (1906), No. 7, pp. 402–406*).—A discussion is given of the reported occurrence of rhizomorphs of *Armillaria mellea* on grape stocks, and the author announces the identification of the basidiomycetes, *Collybia velutipes*, and *Marasmius borealis* on material submitted for study. The latter species is believed to be in all probability a saprophyte.

A new Plowrightia from Guatemala, W. A. KELLERMAN (*Jour. Mycol., 12 (1906), No. 85, pp. 185–187, pl. 1*).—A disease of the American century plant (*Agave americana*) is described, which attacks the living leaves at a few points, the infection proceeding rapidly until the entire leaf may be involved.

The fungus appears to be an undescribed species of Plowrightia, and the author has designated it as *P. williamsoniana* n. sp. A technical description is given.

A blister blight of tea, H. H. MANN (*Indian Tea Assoc. [Pamphlet] 3, 1906, pp. 13, pls. 5*).—A serious outbreak of blister blight on tea in Upper Assam has drawn especial attention to this disease on account of the completeness of the destruction which it causes in a very short time and of the local character of its appearance.

The disease is caused by the fungus *Exobasidium vexans*, which can be found sporadically on tea leaves throughout the year, but becomes epidemic only from April to June. The infection is carried from season to season by these sporadic leaves, and germination appears to take place only on a wet leaf or stalk. It usually requires about 10 days from germination to become visible on the leaves, and in about 2 or 3 weeks the disease reaches the characteristic white stage.

As a rule the least healthy and vigorous bushes are those most subject to the blight, the best plants generally being less affected, and on this account the author recommends measures that will tend to increase the vigor of the plants.

The occurrence of Lasiodiplodia on cacao and mangoes, VERA K. CHARLES (*Jour. Mycol., 12 (1906), No. 84, pp. 145, 146*).—A brief account is given of an investigation of diseased wood and fruits of cacao which were sent to this Department from Brazil for examination. Subsequent consignments showed the same disease to be present in San Domingo and also on the fruit of mangoes that probably came from Florida. In both instances the fruits were found

to be infected with a species of Lasiodiplodia, but whether the fungus is *L. tubericola* or a new species is yet to be determined.

It is thought possible that this fungus may be connected with the witches' broom disease, which is so destructive to cacao, but as yet this has not been established by cultural experiments.

A bacterial disease of oleander, C. O. Smith (*Bot. Gaz., 42 (1906), No. 4, pp. 301–310, figs. 4*).—An examination was made during the autumn of 1905 of some diseased oleanders which were sent to the pathological laboratory of the University of California.

These plants were affected with large, hard, woody knots on stems and leaves, and their appearance suggested the possibility of their relationship with the olive disease known as olive knot or tuberculosis. Cultural experiments were carried on with the organisms causing the disease and reciprocal artificial inoculations were made from the olive to the oleander. It was found that the disease in both is caused by the same organism. The cultural characteristics of the organisms isolated from both plants are essentially alike in all respects.

The Alternaria blight of ginseng, H. H. Whetzel (*Cornell Countryman, 4 (1906), No. 2, pp. 33–41, figs. 9*).—The cultivation of ginseng, having become of considerable economic importance, has led to a study of a number of diseases, and the author describes the Alternaria blight, which has proved exceedingly destructive in some localities. The species of Alternaria has not yet been determined, but from experiments it has proved to be truly parasitic and constantly associated with the disease.

A description is given of the effect of the fungus on the host plant, particular attention being paid to the destruction of the seed crop. For the prevention of injury it is recommended that the plants be sprayed with a 4–6–40 solution of Bordeaux mixture, to each 100 gal. of which is added about a gallon of a resin-soda mixture.

Infectious chlorosis of some mallows, E. Baur (*Sitzber. K. Preuss. Akad. Wiss., 1906, No. 1; abs. in Bot. Centbl., 103 (1906), No. 2, p. 21*).—An account is given of experiments with a form of chlorosis observed upon certain species of Malvaceæ.

The investigations show that it is infectious within certain groups, but no organism of any kind could be found associated with it. The disease is attributed to the probable action of some of the metabolic products of the weakened plant.

A new disease of Erythrina, J. M. Janse (*Ann. Jard. Bot. Buitenzorg, 2. ser., 5 (1906), pt. 2, pp. 153–197, pls. 6*).—For a number of years a destructive disease of Erythrina, an important coffee shade tree, has been observed in Java, and studies have been carried on to determine its cause.

The disease has been found to be due to bacteria, the principal point of attack being the roots, but very characteristic effects are produced in the trunk, branches, and leaves. The bacteria seem to secrete two enzyms, one of which attacks the lignified cells, while the other dissolves the cellulose.

Studies upon some chromogenic fungi which discolor wood, G. G. Hedgcock (*Mo. Bot. Gard. Ann. Rpt., 17 (1906), pp. 59–114, pls. 10, figs. 3; Jour. Mycol., 12 (1906), No. 85, pp. 204–210*).—This investigation was undertaken primarily as a study of chromogenic fungi which are concerned in the color reactions which take place in stained timber and also on account of the losses to the lumber industry due to the lowering of the grade of lumber in piles through the action of many wood-staining fungi. Attention has been given not only to those which deeply penetrate wood and stain it, but also to those which discolor it superficially.

In his investigations the author found about 20 species of fungi, and these are grouped according to the effect on the wood as follows: Wood-bluing fungi—Ceratostomella 8 species; wood-blackening and wood-browning fungi—Graphium 7 species, Hormodendron 2 species, Hormiscium 1 species; and wood-reddening fungi—Penicillium and Fusarium 1 species each. These different species are described at length, technical descriptions of the organisms and their effect on the timber being indicated, and in addition notes are given on a few species which have not been sufficiently studied for definite characterization.

Dilute sulphuric acid as a fungicide, H. KRAEMER (*Proc. Amer. Phil. Soc., 45 (1906), No. 183, pp. 157–163, fig. 1*).—On account of the efficiency as a fungicide of sulphur when gently heated over steam pipes, the author was led to investigate the action of heat on sulphur and found that when gently heated sulphur gives off large quantities of sulphuric acid. The efficiency of sulphur as a fungicide when used in greenhouses is believed to be due to the sulphuric acid, as relatively little sulphurous acid is formed under greenhouse conditions.

In order to determine whether sulphuric acid has a fungicidal value, the author conducted a series of spraying experiments, a preliminary report of which has already been given (E. S. R., 18, p. 249). Strengths varying from 1 part to 200 to 1 part to 10,000 were used, and the stronger solutions proved to be quite injurious to many kinds of plants. It was found that there was a considerable difference in the resisting power of plants when sprayed in this manner, but most of them could withstand strengths of 1 part to 500 or 1 part to 1,000 without serious injury.

Subsequent to these experiments, an opportunity was offered of treating a rose garden for mildew, in which the bushes were sprayed on 6 successive mornings with a solution containing 1 part of sulphuric acid to 1,000 parts of water. Within a week the mildew had disappeared entirely and the young leaves which were putting forth showed no signs of injury. At the same time a parallel experiment was carried on, using copper sulphate, 1 to 1,000, and roses sprayed with this solution had the tips of the young leaves considerably injured.

During 1904–5 an opportunity was given of testing sulphuric acid, 1 to 1,000, on roses grown in the greenhouse, with the result that the mildew was completely eradicated and the new growth was vigorous.

The author concludes that dilute solutions of sulphuric acid may have a beneficial effect on the plants treated, apart from their fungicidal action. Inasmuch as the antiseptic properties of sulphurous acid are well established, he believes that possibly the combination of sulphurous and sulphuric acid would be more effective than sulphuric acid alone.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Parasitism and mutualism in nature, L. LALOY (*Parasitisme et Mutualisme dans la Nature. Paris: F. Alcan, 1906, pp. VIII + 284, figs. 82*).—In this volume the author has attempted to present a discussion of various interrelations between animals of different groups and between plants and animals. The discussion, therefore, covers parasitism in general, the parasitism of plants upon animals, and of animals on plants, and the various relations which have been demonstrated to exist in the plant and animal generally between individuals of different sorts. The subject of mimicry also receives consideration.

The bird, its form and function, C. W. BEEBE (*New York: H. Holt & Co., 1906, pp. XI + 496, figs. 371*).—The author has studied the anatomy and

physiology of the bird from the standpoint of the purpose and use of the various structures observed in birds.

The subjects discussed in the volume include the framework of birds, their food, various features of the external anatomy, and numerous anatomical peculiarities observed in various groups of birds with suggestions of the purpose which these structures serve. Attention is given throughout the discussion to the relationship of birds to their environment.

Rabbits and their destruction, W. G. Dowling (*Agr. Gaz. N. S. Wales, 17 (1906), No. 8, pp. 805, 806*).—The destruction of rabbits is recognized as a difficult problem in those parts of Australia where their numbers have become excessive. In the author's opinion the best results will be obtained by using net fences to exclude them from certain areas and by cutting off the water supply from their habitats during the summer months.

Animal poisons, E. S. Faust (*Die Tierischen Gifte. Brunswick: F. Vieweg & Son, 1906, pp. XIV + 248*).—The literature relating to the various kinds of animal toxins has been systematically consulted by the author and critically discussed in connection with numerous bibliographical references.

In an introductory chapter the author treats of the nature of animal toxins and their effects and therapeutic uses. The greater part of the volume is occupied with specific discussions of the toxins found in mammals, reptiles, batrachians, fish, mollusks, arthropods, worms, echinoderms, and cœlenterates. Particular attention is given to the poisons produced by certain snakes and the therapeutic treatment of their bites as well as to bee stings and the toxins contained in fish and mollusks.

Game laws for 1906, T. S. Palmer and R. W. Williams, Jr. (*U. S. Dept. Agr., Farmers' Bul. 265, pp. 54, figs. 4*).—The purpose of this bulletin is to present in a brief form a summary of the game laws of the United States and Canada regulating seasons, shipments, sales, and licenses in connection with hunting. The information along this line is brought down to date to include the laws passed in 1906.

Zoological yearbook, 1905, P. Mayer (*Zool. Jahresber., 1906, pp. VIII + 560*).—As in previous reports by the author the zoological literature of 1905 is reviewed in a systematic manner in connection with elaborate bibliographies.

Some results of experiment station work with insecticides, E. V. Wilcox (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1905, pp. 239–280*).—A summary account is given of the more important contributions of experiment station entomologists to the study and practical application of standard insecticides, particularly lime-sulphur-salt wash, petroleum oils, hydrocyanic-acid gas, arsenicals, and soaps, as well as special insecticide methods.

Proceedings of the eighteenth annual meeting of the Association of Economic Entomologists (*U. S. Dept. Agr., Bur. Ent. Bul. 60, pp. 206, pls. 3, figs. 10*).—Most of the articles printed in these proceedings have already been noted in an account of the meeting at which the papers were read (E. S. R., 17, pp. 619–621). The following notes are on papers or discussions which have not previously been noted.

A report was submitted by the committee on nomenclature (pp. 25–28). This committee presented a list of the more important injurious insects with their preferred common and scientific names for the purpose of securing uniformity among entomologists in the use of these names.

A paper by F. V. Theobald contained a discussion of the currant root-aphis (pp. 166–170). *Schizoneura fodiens* attacks the roots of the currant, causing galls which somewhat resemble those of the woolly aphis. The biology of the pest is described. The best treatment is to be found in the use of bisulphid of carbon.

C. Fuller in a paper on The Plague Locust of Natal (pp. 171–174) referred to the work which has been done in Natal in controlling *Acridium purpuriferum*. The best poison for these pests appears to be arsenite of soda at the rate of 1 lb. and sugar 4 or 5 lbs. per 15 gal. of water.

The feeding habits of *Lepisma saccharina* were studied by H. Garman (pp. 174–176). According to the speaker's experiments the silver-fish does not feed upon starch or sugar, but preferably upon animal products, such as glue used in binding books and in the mounting of photographs. Occasionally silk is attacked by the silver-fish, but this is also an animal product of a nitrogenous nature.

Twenty-first report of the State entomologist on injurious and other insects of the State of New York, 1905, E. P. FELT (*N. Y. State Mus. Bul. 104, pp. 45–186, pls. 10, figs. 48*).—As is customary in these reports, a brief account is presented of the general features of entomological work during the season.

The author has continued to give attention to the grape rootworm, and finds that by the thorough application of arsenicals, combined with the use of beetle catchers and with cultivation of the soil to kill the pupae, badly infested vineyards may be protected until they recover from the attacks of the grape rootworm. In some cases, however, vineyards have practically been ruined by this pest. The insect is more injurious on loose sandy soils than on heavy clay soils. The use of arsenicals alone will ordinarily not give complete satisfaction.

An account is also presented of outbreaks of the army worm and of the life history and injurious attacks of various species of grass webworms belonging to the genus Crambus. In fighting the San José scale, lime-sulphur washes were used as prepared according to 11 different formulas. The general results were very similar where external heat was applied in preparing the wash, but the author prefers a formula calling for 20 lbs. of lime and 15 lbs. of sulphur in 50 gal. of water, boiled at least 30 minutes.

During the season notes were made and are recorded in the report on codling moth, apple maggot, rose beetle, scurfy scale, white grubs, and various insect pests of shade and forest trees. The shade-tree problem of the State is discussed, with especial reference to the insects which are concerned in injuring these trees. A test was made of the Caucasian bee. This bee appeared to be quite healthy and reasonably gentle, but was not received early enough in the season to give it a fair test.

The mosquito problems of the State are also mentioned with reference to campaigns of draining and insecticide work against these pests. A number of gall insects are described and notes given on the malformations caused by these insects on various plants.

Report of State entomologist of Georgia for 1905. The crop pest law of Georgia, R. I. SMITH (*Ga. Bd. Ent. Bul. 20, pp. 161–195*).—During the year under report considerable inspection work was done and entomological information was also spread through the agency of farmers' institutes. Particular attention is given in this report to a discussion of the most important insect enemies of peach, apple, pecan, cotton, grain, and garden crops.

A copy is also given of the crop pest law of Georgia and of the regulations of the Georgia State Board of Entomology.

Means of combating grain insects, I. F. HOFFMAN (*Illus. Landw. Ztg., 26 (1906), No. 80, pp. 690–692, figs. 6*).—Notes are given on the habits and injurious attacks of a number of grain insects, particularly the granary weevil.

In combating these pests the author has had the best success from the use of carbon bisulphid and anilin milk. The carbon bisulphid proved effective in

all cases, but was subject to some disadvantages as compared with anilin milk. The latter preparation is made by adding anilin oil to water in the proportion of 1 : 15. The mixture in then sprayed or painted on the cracks and walls of the granary and the fumes produced exercise a fatal effect upon insects for a long time thereafter. The author states that it is perfectly safe for human beings to work for a period of 2 hours in the fumes produced from such treatment, but that a longer period might cause nervous disturbances or other signs of poisoning.

The brown-tail moth and how to control it, L. O. Howard (*U. S. Dept. Agr., Farmers' Bul. 264, pp. 22, figs. 10*).—A general account is presented of the introduction, distribution, appearance, and life history of the brown-tail moth with particular reference to injury to forest and other trees and the effect produced by the barbed hairs of the caterpillars upon the skin of human beings.

Among the natural enemies of this pest a number of birds are mentioned, particularly cuckoos, orioles, vireos, and blue jays. Native parasites are known to attack them and recently an effort has been made to introduce European parasites. It is too early to predict the results of this importation.

In combating the pest by artificial remedies the best results follow the practice of destroying the caterpillars in their winter nests. These webs or nests may be readily observed as soon as the leaves fall and should be removed before the caterpillars again become active in the spring. If this is not done resort should be had to arsenate of lead or Paris green. The essential features of the recent Massachusetts law regarding the brown-tail moth are given.

Codling moth and fruit fly, A. H. Benson (*Queensland Agr. Jour., 17 (1906), No. 3, pp. 155–157*).—While the codling moth is not excessively injurious in Queensland, it is generally distributed throughout the colony, and the author believes that it can not be eradicated. For controlling the pest a destruction of infested fruit and spraying with arsenicals are recommended.

It is believed that the control of the fruit fly can only be accomplished by growing the best varieties of fruit which will pay for the expenditure of time and energy in their care. All infested fruit must then be gathered and destroyed.

Two important scale insects and their control, W. T. Clarke (*Alabama College Sta. Circ. 1, pp. 8*).—Attention is called to the increasing development of the fruit industry in Alabama and to the injuries caused to this industry by the San José scale and the new peach scale.

The same method of attack is available for both of these pests. For this purpose the author recommends the use of lime-sulphur-salt wash prepared according to the formula 30–20–5–60.

A new Retinia attacking Austrian pine, A. Cosens (*Canad. Ent., 38 (1906), No. 11, pp. 362–364*).—*Retinia austriana* is described as a new species. The insect is said to attack Austrian pine by burrowing in the cortical layer of the tree and thus piercing the resin ducts and causing an exudation of gum. The injury to infested trees is quite serious, although the pest is partly controlled by parasites.

Mealy bugs, W. W. Froggatt (*Agr. Gaz. N. S. Wales, 17 (1906), No. 8, pp. 770–779, pl. 1*).—Particular attention is given to a discussion of the appearance and habits of various species of Monophlebus, Pallaeococcus, Icerya, and Callipappus.

A revision of the Tyroglyphidæ of the United States, N. Banks (*U. S. Dept. Agr., Bur. Ent. Bul. 13, tech. ser., pp. 34, pls. 6*).—A number of the species of mites belonging to this family attack stored food products or living plants,

while others are parasitic on injurious insects. The group is, therefore, of considerable economic importance.

Analytical tables are presented to assist in the identification of genera and species, and all species known to occur in the United States are described. A number of these are described as new.

The wing veins of insects, C. W. WOODWORTH (*Univ. Cal. Pubs., Ent., 1 (1906), No. 1, pp. 152, figs. 101*).—The views which have prevailed regarding the origin and homology of insect wings have been greatly at variance, and the author therefore undertook a comparative study of this problem for the purpose of presenting, if possible, a more satisfactory system of classification. The development of the wings and veins was given careful attention, and the origin and position of the veins are discussed for each order of insects. The author's views are compared with those of other investigators, and a bibliography of the subject is appended to the bulletin.

The conclusions reached from this study are that the wings are developed purely as a means of flight and that the dominant factors in their development are mechanical necessities. These factors determine the location of the wings and of the veins, the position of the latter being quite different in different orders of insects. It is believed, therefore, that it is not possible to maintain a strict homology in any wing vein throughout the whole series of insects. The author proposes, nevertheless, to use general terms for these veins in a somewhat elastic manner, recognizing the fact that veins of the same name may not be strictly homologous.

Introduction of parasites, C. HARPER (*Jour. Dept. Agr. West. Aust., 14 (1906), No. 3, pp. 175–178*).—A controversy having arisen regarding the desirability of expending money in the collection of parasites, the advisory board of the department of agriculture of Western Australia investigated the matter and reports that, in their opinion, the evidence thus far accumulated is in favor of putting forth a reasonable amount of effort to secure all possible parasites of the more important injurious insects.

Some flagellate forms found in the intestinal tracts of diptera and other genera, A. LINGARD and E. JENNINGS (*London: Adlard & Son, 1906, pp. 25, pls. 5*).—A microscopical examination was made of the intestinal contents of the common house fly, *Stomoxys calcitrans*, mosquitoes, and other insects. In this study particular attention was given to the morphology of the flagellate organisms found in the intestines of flies and upon the influence of the food which they received upon the number and character of these organisms.

The breeding habits of the tsetse fly, E. A. MINCHIN (*Nature [London], 74 (1906), No. 1930, p. 636*).—The author quotes from the letter of A. G. Bagshawe a statement that the latter has succeeded in finding the pupæ of tsetse flies in the soil about the roots of bananas in a large plantation.

Observations indicate that the adults can fly to a distance of 1 mile from the place where they originate.

The extirpation of the tsetse fly, E. A. MINCHIN (*Nature [London], 75 (1906), No. 1932, p. 30*).—The presence of the tsetse fly in considerable numbers was noted in a locality where banana plantations were supposed not to exist. Later such plantations were found, and the author suggests that if the tsetse fly breeds only in banana plantations it might be practicable to combat them by introducing jungle fowl and other birds which would feed upon them in such places.

Analyses of Paris green, J. P. STREET (*New Jersey Stas. Bul. 195, pp. 12*).—A copy is given of the law of New Jersey regulating the sale of Paris green. In accordance with this law, 30 samples of Paris green were analyzed and 20

were found to be of undoubted purity. No sample contained more than 3 per cent of free arsenious acid, but 3 samples did not contain the required 50 per cent of arsenic in combination.

The requirements of the law are so moderate that it is believed all manufacturers can easily conform to them by giving attention to the matter.

Report of the inspector of fumigation appliances, 1905, P. W. HODGETTS (*Toronto: Ontario Dept. Agr., 1906, pp. 7*).—An inspection was made of the larger nurseries in the province of Toronto. In some localities the San José scale is spreading rapidly and effective means have not been taken for controlling it. In general the fumigation appliances of the various nurserymen were found to be satisfactory.

Report of the commission on the rearing of silkworms for 1905, GODINOT (*Ann. Soc. Agr. Sci. et Indus. Lyon, 1905, pp. 440–446*).—The members of the commission appointed for the encouragement of the silk industry report that they have traveled quite extensively throughout the territory under their supervision and have assisted in furthering the industry of raising silkworms by expert advice and the use of government subsidies allowed for this purpose.

The production of silk and other details are presented in a tabular form.

FOODS—HUMAN NUTRITION.

Standards of purity for food products (*U. S. Dept. Agr., Office Sec. Circ. 19, pp. 19*).—The food standards given are intended to supersede and supplement those contained in publications previously noted (E. S. R., 16, p. 894; 17, p. 1096).

Standards for tea and coffee have been added and some additions have been made to the standards previously published for meat and meat products, milk and milk products, fruit and fruit products, flavoring extracts, and edible vegetable oils and fat, and a few modifications have also been made in the text.

Rules and regulations for the enforcement of the Food and Drugs Act, L. M. SHAW, J. WILSON, and V. H. METCALF (*U. S. Dept. Agr., Office Sec. Circ. 21, pp. 20*).—The rules and regulations recommended by the committee appointed from the Departments of the Treasury, Agriculture, and Commerce and Labor regarding the enforcement of the Food and Drugs Act, approved by Congress June 30, 1906, are embodied in this circular, as well as the full text of the Food and Drugs Act.

Some experiment station work relating to the food and nutrition of man, R. D. MILNER (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1905, pp. 225–237*).—Attention is directed to the large amount of work which has been done by the experiment stations, aside from that carried on in cooperation with the nutrition investigations of the Office of Experiment Stations. Numerous examples of the work are cited, particularly of studies pertaining to production and distribution of food, improvement in yield and quality of cereals, improvement in character of dairy products, food preservation and preparation, and food adulteration.

"Although the stations have already performed in the aggregate a large amount of work along the lines referred to in the present article and in related lines not mentioned, the indications are that similar work will be undertaken still more extensively in the future. For example, there is a growing opinion that the energies of the station should be directed toward the solution of the problems of the various industries for the utilization of farm crops as well as toward the production of the crops; that more attention should be devoted, for instance, to the study of the technology of the preparation and preservation

of butter, cheese, evaporated fruits and canned goods, macaroni, and other prepared cereal products, etc. Studies on canning and preserving, the manufacture of special cereal foods, and other lines of work which have to do with the preservation and distribution of food products bear an important relation to both producer and consumer."

The nutritive value of bread as compared with breakfast foods, R. HARCOURT (*Amer. Food Jour., 1 (1906), No. 10, pp. 18, 19*).—Results of digestion experiments with corn meal farinas and several commercial breakfast foods are reported and compared with average results obtained by other investigators with cereal goods and with bread.

The author concluded that the special foods studied were less thoroughly digested than white bread. From the data presented it is evident, in his opinion, "that corn meal, rolled oats, and bread are among our most economic foods. It is, however, true that rolled oats, or even the farinas, do not agree with everyone, and that the predigested goods may be useful food for people who have difficulty in digesting starch. They may also have a place in a hurry-up breakfast. It is evident that a curious name of a much advertised food does not indicate a high nutritive value, and the intelligent buyer who has to consider economy will hardly pass by the old forms of breakfast foods and bread unless their own actual experience has demonstrated that these newer foods have a superior value to them."

A proposed method for examining bleached flour, R. H. SHAW (*Jour. Amer. Chem. Soc., 28 (1906), No. 6, pp. 687, 688*).—The commercial processes for bleaching flour artificially very generally make use of the higher oxids of nitrogen, and when devising a method for the detection of bleaching it was assumed that some nitro body might exist either as residual nitric oxid or as a nitro starch compound.

The proposed method consists in extracting the flour with boiling alcohol, cooling, filtering, evaporating nearly to dryness, extracting the residue with a mixture of equal parts of alcohol and ether, and filtering. The filtrate is evaporated to a sirup-like consistency and distributed in a film over the porcelain dish used and a drop of sulphuric acid solution of diphenylamin is allowed to trail over the film. In the tests reported this left a blue path in every case where the flour used had been artificially bleached, while no coloration was perceptible in unbleached flour.

"A flour bleached by a process using ozone alone as a bleaching agent would probably not respond to the diphenylamin test. Such a process, however, is not used in the West to the writer's knowledge. It is also possible, but highly improbable, that a flour might be found which, fresh from the wheat, would yield the blue color when tested. To decide these points a much larger number of samples will be examined."

A contribution to the history of the use of bark bread, F. T. DILLINGHAM (*Bul. Bussey Inst., 3 (1906), pt. 5, pp. 120–128*).—The inner bark of trees, particularly conifers, has been frequently used by inhabitants of northern countries as a food in times of dearth. The data on the subject are summarized, as well as the results of studies of nine samples of bark.

It was found that the barks apparently contain decidedly smaller quantities than wood of mannan (the constituent on which it was assumed the food value would depend). "It is not to be denied, as yet, that the mannan in bark bread may be of real importance for human sustenance; but, to all appearance, further work will be needed to account completely for the physiological significance of this kind of food."

Rolled oats, T. MACFARLANE (*Lab. Inland Rev. Dept. [Canada] Bul. 127, pp. 12*).—To determine whether the flaked and rolled oats manufactured and sold

in Ottawa were of inferior quality, as had been claimed, 155 samples were collected and analyzed.

Of these 64 samples showed a crude fiber content higher than 2 per cent, "and this would seem to indicate that with regard to 11.3 per cent of the oatmeal samples now offered for sale in the Dominion the quality might be improved. At the same time none of the samples were found to contain the large amount of oat hulls originally complained of, and in the absence of any standard, it is impossible to characterize any of the samples as adulterated."

From fuller analyses which were made of a number of the samples it appeared that the otmeals contained on an average 12.3 per cent protein and 4.67 per cent fat.

Experiments with simple food stuffs, L. Jacob (*Ztschr. Biol., 48 (1906), No. 1, pp. 19–62*).—Previous investigations on animals fed with single food stuffs, although contradictory in some ways, in general led to the conclusion that as compared with the ordinary mixed diet such a diet is harmful, the absence of appetizing qualities in the diet rendering it monotonous and unpalatable.

In the investigations reported starch, olive oil, casein, sugar, salts, and crude fiber were among the materials employed. No bad results followed the use of a diet of such foods in experiments with pigeons and rats. The author notes, however, that appetite is very important and that often animals used for experimental purposes refuse food, lose weight, and even die on a diet which is nutritious, but which has become unpalatable.

Is freshly slaughtered beef palatable and wholesome? J. Hladik (*Ztschr. Hyg. u. Infectionskrank., 54 (1906), pp. 130–146; abs. in Ztschr. Fleisch u. Milchhyg., 17 (1906), No. 1, p. 23*).—Numerous and long-continued experiments led the author to conclude that cooked meat eaten in considerable quantity did not produce any digestive disturbance and that freshly slaughtered meat was palatable if well prepared.

Canned meats, T. Macfarlane (*Lab. Inland Rev. Dept. [Canada] Bul. 123, pp. 26*).—Of the 322 samples of canned and potted meats and similar products examined 15.8 per cent were found to contain boric acid. This was the only preservative identified, though others were looked for. The quantity found was small "not exceeding the limit fixed by the English parliamentary commission of 0.5 per cent," and was probably added in the form of borax.

Potted meats and bologna sausages, T. Macfarlane (*Lab. Inland Rev. Dept. [Canada] Bul. 125, pp. 10*).—Microscopical examination showed the presence of foreign starch and consequently cereal meal of some sort in 90 samples of potted meats referred to in an earlier bulletin (see above).

The author points out that such addition can not be considered adulteration if the fact is indicated by the name of the article. "It may be that this is done by the use of the word 'loaf' in a great many instances. But the words 'potted,' 'deviled,' etc., do not justify the addition of flour or corn meal, and articles with such names can not be regarded as otherwise than adulterated if they have received additions of cereal products."

Data are also given regarding the composition of commercial goods containing cereal products intended for use in the manufacture of potted meats and similar products.

Only one of the samples of potted meats was found to contain foreign coloring matter. Of 32 samples of bologna sausage examined, 5 contained added preservatives and 11 artificial dyes.

Experiments on the digestibility of fish and poultry, R. D. Milner (*Connecticut Storrs Sta. Rpt. 1905, pp. 116–142*).—Following the usual methods the digestibility of canned salmon, fresh cod steaks, canned chicken, and fresh roast duck were studied with 4 healthy men as subjects, the special foods fur-

nishing an integral part of a simple mixed diet. The digestibility of the fish and poultry alone was calculated; the average results follow:

Coefficients of digestibility of fish and poultry—average of four tests.

Kind of food.	Protein.	Fat.	Energy.
	Per cent.	*Per cent.*	*Per cent.*
Salmon (canned)	96.23	97.01	85.63
Cod	95.93	97.40	80.27
Chicken (canned)	96.74	97.13	85.35
Duck	94.66	97.32	91.14

"From the results of 16 experiments in which canned salmon, fresh cod, canned chicken, and roast duck made up in turn a considerable portion of the diet, it appears that these foods are very completely digested, the coefficients of digestibility being approximately those previously found for other animal foods. The foods containing a considerable proportion of fat were apparently as completely digested as those in which the percentage of fat was relatively small. The number of kinds of poultry and fish investigated and the number of experiments carried on with each are too small to warrant further conclusions."

Composition of tamarind pulp, O. REMEAUD (*Jour. Pharm. et Chim., 6. ser., 23 (1906), No. 9, pp. 424–430*).—Analyses were made of commercial crude and purified tamarind pulps and of pulp prepared by the author from fruit collected at Saigon.

The "dry extract" ranged from 62.8 to 73 per cent, the ash from 2.8 to 3.3 per cent, and the total acidity, calculated as tartaric acid, from 11.7 to 15.9 per cent. Tartaric acid, acid potassium tartrate, and invert sugar were identified as prominent constituents of the fruit.

Coffee, coffee products, and coffee surrogates, E. FRANKE (*Kaffee, Kaffeekonserven und Kaffeesurrogate. Vienna and Leipsic: A. Hartlebens, figs. 32; rev. in Österr. Chem. Ztg., 9 (1906), No. 20, p. 281*).—The preparation of coffee for the market is described, as well as the manufacture of coffee products and of coffee substitutes from figs, grains, malt, etc.

Preserved food products, J. DE BRÉVANS (*Les conserves alimentaires. Paris: J. B. Baillière & Sons, 1906, 2. ed., pp. VIII + 467, figs. 74*).—This handbook discusses the general principles of food preservation, the preservation of products of animal and vegetable origin, adulteration of products made from meat, milk, butter and eggs, vegetables and fruits, and the analysis of preserved foods.

Food preservatives, A. MCGILL (*Lab. Inland Rev. Dept. [Canada] Bul. 126, pp. 32*).—Data regarding the character and effects of food preservatives are summarized and discussed, such a collection of information being regarded as a necessary preliminary to the making of regulations under the provisions of the Canadian Adulteration Act regarding the limits within which preservatives may be used.

General results of the investigations showing the effect of salicylic acid and salicylates upon digestion and health, H. W. WILEY (*U. S. Dept. Agr., Bur. Chem. Circ. 31, pp. 12, fig. 1*).—Elaborate studies were made of the effects of salicylic acid taken with food for a period of 30 days, the experimental period being preceded and followed by normal periods of 10 days' duration. Salicylic acid was given in small and increasing doses, beginning with 0.2 gm. and increasing to 2 gm. per day. The diet was varied so as to give a choice of meats and vegetables with bread, butter, milk, coffee, and tea. Foods of the best quality and free from added preservatives or coloring matter were used.

The young men who served as subjects were under medical supervision during the entire experimental period. The amount and composition of the excreta were determined and the food products were analyzed. Special studies were made of the sulphur occurring in the urine, and especially of the relation of sulphur compounds to nitrogen. Microscopical studies were made of the urine and of the blood, and "all possible precautions, in view of the magnitude of the work, were observed in securing a complete chemical and clinical control of each one of the young men engaged in the experimental work." The general deductions are based on results obtained with 9 subjects.

The data reported "show very clearly that salicylic acid and salicylates appear to exert an exciting influence upon the activities which take place in the alimentary canal, stimulating the organs to greater effort, and this stimulation leads at first to increased digestion and absorption of the foods which are introduced into the stomach. In the light of the data which are exhibited salicylic acid may be said to increase the solubility and absorption of the food in the alimentary canal, so that larger parts of the nutrients taken into the stomach actually enter the circulation." This belief "is perhaps to a certain extent undeserved."

"This work is offered as an unbiased study of all the data recorded, both of those which appear to be in favor of the use of salicylic acid and those which appear to be against its use, and leads to the inevitable conclusion that salicylic acid is a substance which, when added to foods even in small quantities, exerts a depressing and harmful influence upon the digestion and health and the general metabolic activities of the body. Further, there appears to be no necessity for its use, as food can be preserved in unobjectionable ways without its aid. Its indiscriminate use would tend to carelessness in the quantities employed, thus increasing the dangers to which the consumer is subjected. Also its use in the preservation of foods tends to induce carelessness and indifference on the part of the manufacturer, as when a chemical antiseptic is employed many of the processes necessary to the proper selection, cleaning, and preservation of foods may be omitted. The addition of salicylic acid and salicylates to foods is therefore a process which is reprehensible in every respect and leads to injury to the consumer, which, though in many cases not easily measured, must finally be productive of great harm."

It was found on an average that the dry matter of the food consumed was equivalent to 0.9 per cent of the body weight.

Diet and dietetics, A. GAUTIER, edited and trans. by A. J. RICE-OXLEY (*London: Archibald Constable & Co., Ltd., 1906, 2. ed., pp. XII+552, figs. 10*).—In this general treatise on food and nutrition the author considers the principles which underlie the subject, methods of experimenting, characteristics of the nutritive value of different foods, diet in different circumstances of health and disease, and related questions. Many of the author's investigations are summarized and numerous references are made to the literature of the subjects discussed.

Food and dietetics, ALICE P. NORTON (*Chicago: American School of Household Economics, 1905, pts. 1, pp. 1–61, figs. 9, charts 4; 2, pp. 62–116, figs. 10, chart 1; 3, pp. 117–187, figs. 16*).—The proportion of total income expended for food and in other ways, characteristics of different animal and vegetable foods, composition and digestibility of food, special diets, dietaries, and dietary standards, and related questions, are discussed in the form of a series of lessons designed for instruction by correspondence.

Accuracy in dietetics, D. ROBERTS (*Jour. Amer. Med. Assoc., 46 (1906), No. 16, pp. 1162, 1163*).—In order to facilitate the calculation of the nutritive value of rations the author has prepared a table showing the weight, protein content,

and fuel value of household measures (glassful, teaspoonful, tablespoonful, etc.) of a number of common food materials.

Dietary studies of a week's walking trip, H. L. KNIGHT (*Connecticut Storrs Sta. Rpt. 1905, pp. 143–163*).—An account was kept of the food eaten by 2 young men during a 7 days' walking trip. Each carried about 25 lbs. of luggage and covered about 20 miles per day.

Generally speaking the foods selected were those supplying nutritive material in small bulk. One of the subjects obtained on an average 86 gm. protein and 3,189 calories of energy per day and the other 56.6 gm. protein and 1,866 calories of energy.

A portable ration for soldiers in battle and on the march, L. L. SEAMAN (*Jour. Amer. Med. Assoc., 46 (1906), No. 21, pp. 1606–1608*).—An efficient ration for soldiers in battle and on the march, it was pointed out, must furnish proximate constituents in necessary proportion, must be easily digested and palatable, and have a minimum waste.

In the author's opinion, smoked beef is a valuable constituent of such a ration as it is easily digested and palatable, may be eaten raw or cooked, and does not become distasteful as soon as canned roast beef or corned beef. For the carbohydrate constituent of the ration he suggests a mixture of 7 parts rice and 3 parts barley meal, cooked, dried, and ground. Tea or coffee is regarded as an essential part of the proposed ration, which also includes sugar, chocolate, salt, and pepper. The calculated protein content is 93.29 gm. and the energy value 2,672 calories.

The nutritive requirements of the body, F. G. BENEDICT (*Amer. Jour. Physiol., 16 (1906), No. 4, pp. 409–437*).—A general discussion of theories of metabolism with special reference to recently published work of a number of investigators.

The author concludes that the evidence which has been presented is far from sufficient to warrant the assertion that the amounts of protein ordinarily consumed should be permanently and materially diminished, and believes that there is evidence to show that permanent reductions are decidedly disadvantageous and, indeed, not without possible danger.

Basing his deductions upon the results obtained by the respiration calorimeter (E. S. R., 15, p. 698) and the fact that the law of the conservation of energy obtains with the animal body, the author points out that the energy intake can be diminished only as the energy output or the muscular activity is diminished. "These facts make any proposition to lower food consumption unaccompanied by decreased muscular activity impracticable."

ANIMAL PRODUCTION.

Live stock (*Quart. Rpt. W. Va. Bd. Agr., 1906, No. 3, pp. 132, figs. 33*).—A number of papers by different authors on the feeding and care of live stock, diseases and their treatment, and related questions, and a summary of the laws of West Virginia relating to infectious and contagious diseases of animals.

Storage barn, sheds, feed lots, and other equipment for feeding experimental cattle in carload lots, H. W. MUMFORD and E. S. GOOD (*Illinois Sta. Bul. 110, pp. 303–324, figs. 6, dgms. 9*).—The general plan of the experimental plant used at the station for beef cattle feeding experiments is described and a detailed description given of the construction of the storage barn, methods of preparing and handling feed, and of the construction and operation of the feed lots, the sheds and feed carrier system and of the corn crib and engine house, as well as a general summary of the cost of the plant as a whole.

"The general plan of the experimental feeding plant at this station, for the feeding of 200 head of beef cattle in carload lots, and individually, consists of a storage barn facing east and west and two rows of feed lots connected by a paved alley, lying east and west from the west side of the storage barn. South of the feed lots is a corn crib 144 feet in length, and north of the storage barn is a 20 by 28 foot engine house. On the west side of the barn and north of the alley are stock scales.

"There are twelve feeding lots in the two rows mentioned, seven of which are situated on the south side of the alley and five on the north side. All face to the south and all are paved with brick with the exception of three lots on the north side of the alley, one of which is used for experimenting with cattle fed in an ordinary earth lot. The sheds on the south side of the alley are open on the south side, while those on the north side are inclosed and provided with large sliding doors. None are paved.

"Feed carriers convey the concentrates and chaffed roughage from the second floor of the storage barn to the lots on the south side of the alley."

Maintenance rations for beef-breeding cows, H. W. Mumford (*Illinois Sta. Bul. 111, pp. 324–342, figs. 4*).—Using 3 lots of 10 grade cows 3 to 6 years old, corn silage, shock corn, and corn stover were compared with a view to securing data regarding the relative value of cheap feeds available on Illinois farms for maintaining beef-breeding cows during the winter season. The corn feeds were supplemented by clover hay and oat straw, except that for about the first two-thirds of the period no clover hay was used in the corn-stover ration.

To determine whether ensiling the corn is more valuable for winter feeding than curing it, the amount of corn and its accompanying coarse fodder was made the same in the silage and shock corn rations. "In the selection of the feeds to be fed, an effort was made to use such as are not looked upon as cash crops of the farm, but more in the nature of by-products of low commercial value."

In 140 days the average gain on the silage ration was 1.07 lbs. per cow per day, the amounts eaten being 16.65 lbs. silage, 3.5 lbs. clover hay, and 9.56 lbs. oat straw. On shock corn the gain was 0.758 lb. per cow per day, the feed eaten being 8.7 lbs. shock corn, 3.5 lbs. clover hay, and 10.83 lbs. oat straw. On corn stover the gain was 0.41 lb. per cow per day, the feed eaten being 21.67 lbs. corn stover and 5.15 lbs. oat straw when the cows received no clover hay, and when stover hay was used 10.29 lbs. corn stover, 1.56 lbs. clover hay, and 8.19 lbs. oat straw.

As the experiment progressed the cows fed silage and shock corn were in better condition and more contented than those fed the corn stover, and, furthermore, the character of the feces indicated that in the latter case there were digestive disturbances. No such disturbances were noted with the cows fed the silage and the shock corn.

"The corn plant, fed either in the form of shock corn or silage, supplemented with a limited amount of clover hay, proved satisfactory rations for wintering beef-breeding cows." "Under the conditions of this experiment, silage produced 41 per cent greater gain in live weight than an equal acreage of shock corn."

For a part of the test the cows were allowed free access to loose salt, and a record was kept of the amount consumed. The average daily consumption was 0.08 lb. on the silage ration, 0.12 lb. on the shock-corn ration, and 0.10 lb. on the corn-stover ration.

Two of the cows fed corn silage and 2 fed shock corn dropped calves and were removed from their respective lots. At the end of the test the oldest calf was 70 days old, and in no case had they been given other feed than the milk of

their dams. The average gain of the calves ranged from 1.49 lbs. per head per day to 1.98 lbs., both extremes being found with calves from the corn silage lot. The average daily cost of keeping the silage-fed cows which calved was 7.56 cts. and those fed shock corn 6.84 cts. Before calving the average daily cost was 5.8 cts. and 5.5 cts., respectively.

"In this test it took approximately twice as much feed to maintain a cow when suckling a calf as it did during her pregnancy. . . .

"Corn plant fed in the form of silage is more palatable than if fed in the form of shock corn, which may be the cause of its being more efficient for the maintenance of beef-breeding cows.

"The yield of crops used in this test was 57.9 bushels of corn and 2 tons stover per acre; and for crops purchased, viz, clover hay and oat straw, yields of 1¾ and one ton, respectively, were assumed.

"On the above basis approximately one acre of land is sufficient to produce the crops necessary to support a breeding cow 140 days in winter, and this acreage should produce a considerable amount of grain in addition to that necessary for the maintenance of one cow.

"The product of one-third acre of land is sufficient to maintain a cow 140 days in winter, if we regard the surplus grain produced as offsetting an acreage proportionate to its market value."

Feeding experiments with cattle, E. R. Lloyd (*Mississippi Sta. Rpt. 1905, pp. 11–13*).—In a comparison of cotton-seed hulls with corn silage for beef production, it was found that 6 steers in 45 days made a total gain of 451 lbs. and consumed 240 lbs. of silage, 1,482 lbs. of hulls, 1,350 lbs. of hay, and 1,752 lbs. of cotton-seed meal and corn chops. A similar lot fed the silage ration gained 570 lbs. and ate 2,973 lbs. of silage, 240 lbs. of hulls, and the same quantities of the other feeding stuffs as the first-mentioned lot. "The results show 1 lb. of hulls equal to 1.58 lbs. of ensilage. This indicates ensilage to be the cheaper feed."

Some data are recorded regarding the cost of rearing and wintering cattle and regarding pasture gains. The estimated total cost of raising a "feeder" to the end of the third year was $23.75, the average weight of the steer 930 lbs., and the calculated net profit $13.45. The feed required to finish the steers cost on an average $11.42 per steer, making the estimated net profit when the finished animals were sold, $14.10.

The cost of growing and finishing young cattle was studied with 5 calves, which ran with their dams through the first winter without additional feed, then were pastured through the summer and wintered as yearlings on hay, and finished and sold the following winter when 28 months old. The cost of feeding to the beginning of the finishing period was $12.99 per head and during the finishing period $12 per head. Taking into account the cost of marketing, the net profit per steer was calculated to be $17.26. During the 135 days of the fattening period the "best daily gain was 2 lbs.; the smallest daily gain was 1.65 lbs."

The estimated cost of wintering a breeding herd of 18 cows and a bull was $84.10, or $4.66 per cow. The cattle had access to a rick of hay, and from December 29 to April 1 were fed a little cotton-seed meal and hulls and as much shredded fodder as they would eat up clean. The above estimate includes the purchased feed hulls and cotton-seed meal, but does not take into account the home-grown hay.

As regards gain made on pasture, it was found that 3-year-old steers which had been wintered on hay without grain gained 209 lbs. per head on an average when pastured from April 1 to November 15. Yearling steers which had been fed during the winter on corn, cotton-seed meal and hulls made an average gain

of 15 lbs. per head on pasture, and young heifers which had been wintered on hay without grain gained, on an average, 191 lbs. on pasture.

For several years wheat has been included in the station's system of crop rotation for producing hay. It is cut in the dough stage and cured, the land being then plowed and planted to corn or to cowpeas. To determine the effect of grazing on the yield of wheat hay, 8 calves were pastured on a plat of 3.75 acres for one month. They averaged 350 lbs. in weight "and made fair gains on the wheat without other food." The grazed wheat headed out and was ready to harvest 10 days later than a similar plat which had not been grazed, the yield of hay from the two plats being respectively 1,210 lbs. and 1,812 lbs. per acre.

Steer feeding, A. SMITH (*Mississippi Sta. Rpt. 1905, pp. 18, 19*).—A test was undertaken to compare stable feeding with feeding in an open yard and to study the relative merits of a mixed ration of hay, corn meal, wheat bran, cotton-seed meal and cotton-seed hulls with a ration of cotton-seed meal and hulls alone. Seven steers fed the mixed ration in the stable for 96 days made an average daily gain of 2.09 lbs. at a cost of 8.5 cts. per pound. Three steers fed a ration of the same character under the same conditions made an average daily gain of 1.35 lbs. per head at a cost of 10.7 cts. per pound.

A similar lot of 5 steers fed cotton-seed meal and hulls in the stable gained, on an average, 1.93 lbs. per head per day, the cost of a pound of gain being 6.1 cts. Five steers kept in an open lot but with access to shelter when fed the mixed ration made an average daily gain of 2.8 lbs. per head per day at a cost of 9.1 cts. while a similar lot fed meal and hulls in an open lot without shelter gained 1.52 lbs. per head per day at a cost of 8.2 cts. per pound.

The calculated net profit from the cattle used in the above tests was $79.87.

"The results of the experiments serve to show that good cattle can be fed at a profit and that higher prices can be obtained for cotton-seed products, corn, and hay by feeding the same to a good type of beef cattle than by selling in a cash market and at the same time the fertilizer material may be retained on the farm to increase the productiveness of the soil."

Sheep, E. R. LLOYD (*Mississippi Sta. Rpt. 1905, p. 14*).—As shown by the recorded data for 4 years, the average cost of wintering sheep at the station has been $1.14 per head. The estimated profits from a flock of 22 sheep for last year were $42.36 and none of the breeding ewes were sold. "There is ready sale for early lambs at good prices. Sheep could easily be made one of the most profitable lines of live stock farming for the average farmer in this State."

Grazing hogs, E. R. LLOYD (*Mississippi Sta. Rpt. 1905, pp. 13, 14*).—Cowpeas without grain have so far given better results, it is stated, than any of the other crops tested at the station. In 1903 the cowpeas were grown on thin hill land and an acre produced 350 lbs. of pork. In 1904 the crop was grown on good valley land and produced 483 lbs. of pork per acre. The pigs were turned on the pasturage when the cowpeas were ripe and were fed no grain in addition to the pasturage.

Alfalfa without grain has been found "to be little more than a maintenance ration for hogs." The pigs used in the test, which covered 2 years, ranged from 3 to 24 months in age.

Ensilage for horses; dipping for horses (*Natal Agr. Jour. and Min. Rec., 9 (1906), No. 5, pp. 485–488*).—Silage, presumably corn, has been found a satisfactory feed for horses at the Mooi River Remount Depot. The winter ration consisted of 4 lbs. of silage chopped with 2 lbs. of alfalfa or other forage, an ounce of salt, and a few pounds of crushed corn.

It is stated that dipping horses has been successfully practiced and is followed by freedom from ticks and skin diseases.

Farm poultry, with the results of some experiments in poultry houses and fattening chickens, W. R. GRAHAM (*Ontario Agr. Col. and Expt. Farm Bul. 151, pp. 40, figs. 25*).—The rearing, feeding, and management of chicks are discussed on the basis of station experience. The rearing of market fowls, housing poultry, the use of trap nests, construction of fattening crates, the use of the cramming machine, dressing and shipping poultry, egg preservation, and related topics are also spoken of and some experimental work is briefly summarized.

The effect of different housing conditions upon egg production is shown by the fact that during January, February, and March some 50 hens kept in a warm house laid 946 eggs, while a similar lot in a house with a cloth front laid 1,092 eggs. The hens in a cold house laid 1,021 eggs and those in a house with movable windows 1,035 eggs. During the same 3 months of the preceding year the hens in the warm house laid 607 eggs, those in the house with cloth front 718 eggs, in the house with movable windows 819 eggs, and in the cold house 1,074 eggs.

According to the author, "every hen should be allowed at least 6 sq. ft. of floor space. Each bird of the Plymouth Rock, Wyandotte, and such breeds, requires about 9 in. of perch room; Leghorns, etc., about 8 in.; and Brahmas 10 in. Roosts should be made low or near the ground. There are several reasons for this. Fowls of the heavier breed can not fly high, and those of the lighter breeds frequently injure the soles of their feet in jumping from high perches."

In the author's experience, "the best results are obtained from keeping 20 to 25 birds in a flock. Some succeed with 60 to 75 in a flock, but these are the minority."

As regards egg production of different breeds, it was found that 13 Plymouth Rock hens laid 693 eggs, the average cost per dozen being 6.02 cts., and during the same time an equal number of Andalusians laid 834 eggs, the cost per dozen being 5.34 cts.

In general, hens over 2 years old, the author points out, are seldom good layers. "Leghorns, Minorcas, etc., are sometimes good during their third and fourth years; but, generally speaking, the Rocks and such fowls are of little or no use as layers after the second year, being much inclined to become excessively fat.

"For summer egg production the lighter breeds of late-hatched pullets of the heavier breeds are best. Do not expect a hen that has laid well all winter to lay exceptionally well during the summer."

Wet and dry feeding and other similar topics are considered. As regards practice at the Ontario Agricultural College, it is stated that for the last year or two mashes have been little fed, such materials being very largely replaced by sprouted grain. "So far as we can see at the present time, the sprouting does not improve the feeding qualities of the grain very much, with the exception of oats. The palatability of oats is increased considerably. We have made the oats equally as palatable by soaking them in warm water about six hours. At the present time our plan of feeding is to feed whole grain in the litter in the morning, using about one to two pounds for twenty birds, the latter amount when they are laying heavy; at noon feed mangels, clover hay, and meat food in the winter time. If we have no meat, a small quantity of grain is scattered in the litter on the floor. In the summer time no grain or feed of any description is given. At night they are fed all the sprouted grains, either oats or barley, sometimes wheat, they will eat. During very cold weather in the winter they

are fed occasionally corn, either in the morning or evening. Where this is given, it is scattered in the litter."

As regards the merits of natural and artificial hatching, the author is of the opinion that as good results can be obtained with the incubator as with the hen.

In a test of the gains made by chickens fattened in July it was found that 12 Plymouth Rocks fed in a crate gained on an average 2.1 lbs. per head and required 3.2 lbs. of grain per pound of gain. Under similar conditions 8 high-grade Leghorns made a gain of 1.28 lbs. per bird, requiring 3.4 lbs. of grain per pound of gain. When dressed, they were somewhat plumper than the Plymouth Rocks, owing to their being mature, but they were rather small.

The author points out that the majority of buyers regard crate-fed birds as superior to those fed loose in pens. His own preference is for feeding in crates, as it takes less room, and he believes that the poultry can be thus fed with less labor and will produce a more even product. "No matter which method is followed, cockerels should be fed for 2 weeks or more before they are killed and sold."

Tests of the relative value of different grain rations extending over a number of years are summarized. In general, the smallest and most expensive gain was made on a mixture of corn meal and pearl oat dust 2 : 1, and the largest and cheapest gain on corn meal, ground buckwheat, and pearl oat dust 2 : 2 : 1. Skim milk was fed in addition to the grain in all cases.

Data are recorded which show the exact quantities fed to fattening birds, the general principle of such feeding being light rations at the beginning with a gradual increase until all the feed is given which will be eaten up clean. No feed is left before the birds longer than 10 minutes after it is placed in the trough. Some data are also given regarding the relative gains made by individual birds in 3 weeks.

From a summary of data on the relative value of whey, skim milk, and numerous feeds for fattening chickens, it appears that gain was most cheaply made on a mixture of equal parts of corn meal, oatmeal, and shorts mixed with whey, the cost being 4 cts. per pound, and was most expensive (6 cts. per pound) on a mixture of equal parts of corn meal, shorts, and oatmeal, with 30 per cent of pork scrap, water being used to wet up the ration.

"Sour skim milk, i. e., milk that is thickened, is, without doubt, the best liquid to mix with grain rations where a uniform product is wanted, and more so where white-fleshed chickens are in demand.

"Sweet skim milk has not a feeding value for grown chickens equal to sour milk.

"Whey is a better food than is generally considered. The results appear to indicate that it aids digestion.

"Whey and pork scraps have not given the results expected.

"Where pork scrap and beef scrap can be procured at reasonable cost, say 2 cents or less per pound, they are good value, especially where a yellowish flesh is in demand.

"Grain mixtures only, mixed with water, are not economical, considering this test."

Poultry experiments, G. M. Gowell (*Maine Sta. Bul. 130, pp. 101–132, pls. 5*).—Additions to the station poultry plant are described, as well as a recently established poultry farm; methods for the selection of breeding stock are outlined; detailed accounts are given of methods of feeding chickens and hens followed at the station, and experiments are reported.

In a test to determine the effects of early maturity on laying, it was found that a lot of chickens selected in July and August because they were evidently about to begin laying, gave an average of 180 eggs per bird in a year, as com-

pared with 144 eggs per bird from all the station pullets. The large number of eggs laid by the selected early pullets, and the fact that few of them were poor layers, in the author's opinion, shows the advantage of selecting early layers for breeding purposes.

As regards the feed required for raising broilers the station records show that cockerels hatched in April and May, when 11 or 12 weeks old, weighed 2.25 lbs. dressed, and pullets 1.75 lbs. On an average both pullets and cockerels had eaten 9 lbs. of grain, 1 lb. of beef scrap, and 0.25 lb. of grit. The estimated cost of feed required to raise a 2-lb. broiler was 23 cts. "To make broiler raising most profitable, warmed houses should be used and the birds raised early enough to be all marketed while high prices are obtainable."

The dry-feed system of feeding referred to in earlier publications (E. S. R., 17, p. 388) is discussed and data recorded regarding the amounts eaten per hen during the past year, which were grain and meal mixture 90 lbs., oyster shell 4 lbs., dry cracked bone 2.4 lbs., grit 2 lbs., charcoal 2.4 lbs., and clover 10 lbs.

Succulent feeds are supplied to the station poultry throughout the year. In a test beginning January 1 and covering 4 months mangel-wurzels and cut clover were compared with 2 lots of 100 hens each. The lots were fed and cared for alike, except that one received 17 lbs. of mangels per day and the other 5 lbs. of clover leaves and heads. On mangles the average egg yield was 63.9 eggs per hen and on clover 59.6 eggs.

"The slight difference between the yields of the two lots can hardly be regarded as indicating greater value for the mangold ration.

"The vigor and apparent healthfulness of the two lots were equally good. In the general feeding both mangolds and clover are used daily. Formerly it was thought necessary to steam or wet the clover with hot water, in order to get good results from it. It is now cut and fed dry, in the bottom of cement barrels, cut off about ten inches high. About 5 pounds are eaten daily, by 100 hens, with very little waste. Apparently as good results are gotten from it as when it was scalded, the labor of preparation being very much lessened."

Using 50 year-old Barred Plymouth Rock hens, which had been kept by themselves since they were 12 weeks old, the time required to establish fertility in eggs when hens are first mated was studied. All the eggs laid the first day of mating were found to be infertile. Eggs laid the second day showed fertility in different degrees. From 21 eggs laid the third day 10 chicks were hatched. "The eggs laid during the days immediately following the fourth day of mating yielded rather more than 50 per cent of good chicks, which is about the percentage usual in the general incubation work here, which, however, is done earlier in the season, when conditions are supposed to be not as favorable."

It is commonly believed that eggs from hens which have been laying for a long time are less likely to hatch than those produced earlier in the laying period. To test this point, eggs laid the first 10 days of each month from January to October by 40 hens were incubated. The percentage which hatched ranged from 24 in February to 61 in April. The percentage was also noticeably high (52 to 58 per cent) in July, August, and September. "From this test there appears no support of the theory that long-continued laying reduces the chick-producing capacities of the eggs."

The effects of long and short mating periods upon the proportion of eggs which hatched were also studied. From pens where the males and females ran together all winter 3,240 eggs were incubated and 1,529 chicks were hatched, an average of about 1 chick to 2.13 eggs. From pens where the males and females had not been together until the mating season began 2,160 eggs were incubated and 1,075 chicks hatched, or about 1 chick to 2 eggs.

"These slight differences in results should not be interpreted as meaning that there are advantages in the short over the long matings. . . .

"While the results of this test may not be convincing, the 1,500 birds employed and the large number of eggs incubated, with the satisfactory average yields of a chick from 2 eggs, does furnish data sufficient to remove scruples regarding the fitness of long-mated birds for breeders."

Poultry investigations at the Maine Agricultural Experiment Station, C. D. WOODS and G. M. GOWELL (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 90, pp. 42, pls. 5, figs. 2*).—This is a revision of a bulletin of the Maine Station (E. S. R., 15, p. 1104). The new material which has been incorporated consists very largely of descriptions of the station poultry plant, the methods followed in poultry experiments, and the way in which data are recorded.

Poultry division, F. B. LINFIELD (*Montana Sta. Rpt. 1905, pp. 253, 254, figs. 2*).—A brief account of the station poultry and the eggs laid. Hens kept in a small and inexpensive colony house with a drop curtain front and having quite a free range made the best record, producing on an average 165 eggs per bird per year. A new poultry building at the station is described.

Preserving eggs, R. W. THATCHER (*Washington Sta. Bul. 71, pp. 14*).—The relative value for preserving eggs of 10 per cent and 5 per cent solutions of water glass, of a mixture of limewater and salt brine (the limewater being made by mixing a pound of quicklime and 0.5 lb. of table salt with 4 qts. of boiling water), and of a commercial egg preservative were studied. The eggs were placed in stone jars, 50 to a jar, and the liquids poured over them until they were entirely submerged. The eggs were examined at intervals for 8 months.

"These experiments show that eggs can be kept in good condition for home use at least eight months by immersing them either in a water-glass solution or in limewater and salt brine. Those preserved in water glass this year appeared to come out in better condition than those kept in the lime and salt mixture. Other experimenters have succeeded in keeping eggs to their entire satisfaction in solutions of water glass as dilute as 5 per cent, but the author's experience this year was that a stronger solution gave a better preservation. It seems probable that a solution halfway between the two which were used . . . would be better than either of these, since it would doubtless give a better product than the weaker solution and would not deposit sediment, thereby gradually losing strength, as the stronger solution did."

The author calculates that a pound of water glass properly diluted is sufficient to cover 12 to 15 doz. eggs and that the cost of the preservative would be less than one cent per dozen.

"Each day's gathering of eggs may be packed immediately after gathering by placing them in the jar and pouring over them just enough of the solution to cover them. This is better than to hold the eggs for several days, at the risk of their becoming stale, in order to have a sufficient number to fill the entire vessel at one time.

"Eggs packed by . . . [the water glass] method will keep for some time after they are removed from the preservative solution. The author has used some which have been out of the solution for four weeks without being able to detect any deterioration in quality."

DAIRY FARMING—DAIRYING—AGROTECHNY.

Modern dairy farming, H. L. PUXLEY (*London: L. U. Gill; New York: C. Scribner's Sons, 1906, pp. 238, pls. 8, figs. 32*).—This is designed to be a practical handbook for the beginner in dairy farming. It deals not only with such matters as the selection and management of cows, the milk supply, butter

making, and cheese making, but also with the production of various field crops, veterinary remedies, and pig feeding.

The book embodies the results of considerable practical experience and for this reason will doubtless be found very useful, but unfortunately for an elementary treatise it is not entirely free from mere theories or loose statements. For instance the author considers it possible that "in good germs the valuable and health-giving properties of milk reside." And again, "the spores of most bacilli are as easy to destroy as the bacilli themselves."

Report of the dairy commissioner for the Dominion of Canada, 1906 (*Rpt. Dairy Comr. Canada, 1906, pp. 157, pls. 24*).—This report on the progress of the dairy industry in Canada contains considerable statistical matter, results of experiments in the cool curing of cheese, notes on the management of cheese-curing rooms, directions for coating cheese with paraffin, classifications and standards for butter and cheese, plans for cheese factories and creameries, a reprint of a bulletin on creamery cold storage, an account of a visit to Europe in the interests of Canadian dairying, and other articles of a like nature.

Annual report of the association for the development of the dairy industry of Hoorn, 1905 (*Verslag Ver. Exploit. Proefzuivelboerderij Hoorn, 1905, pp. 35*).—This report includes notes and observations on the use of pure cultures in dairying, milk with abnormal properties, ripening of Edam cheese, hay extract, etc.

Report of the experiment station and dairy institute at Kleinhof-Tapiau, 1905–6, HITTCHER (*Ber. Vers. Stat. u. Lehranst. Molkw. Kleinhof-Tapiau, 1905–6, pp. 12*).—An account is given of the work of this institute during the year including data on the production of the dairy herd at the institute and of other herds in that region.

Dairy department, W. J. ELLIOTT (*Montana Sta. Rpt. 1905, pp. 285–288*).—In this report are given the amount and cost of feed and the returns from milk and butter for each of the 15 cows in the station herd during the year. The average profit per cow over cost of feed was $49.20.

Report of dairy department, A. SMITH (*Mississippi Sta. Rpt. 1905, pp. 20–22*).—This report includes a monthly record of 15 cows for 1 year, a brief statement concerning experiments in sheltering cows, and making cheese. The results of a brief trial indicated that exposure to stormy weather caused a shrinkage in the yield of milk. The work with cheese, according to the author, shows that good cheese can be produced in the State.

Preliminary observations on protein supply of dairy herd, T. I. MAIRS (*Pennsylvania Sta. Rpt. 1905, pp. 96–104*).—During 1905 the station herd of 34 cows was divided into two lots, one of which was fed more protein than the other. Records are given of the individual cows for January to May, 1905, and for comparison for the year 1904. The results so far obtained are not considered as warranting any definite conclusions.

Testing cows for advanced registry, C. L. BEACH (*Connecticut Storrs Sta. Rpt. 1905, pp. 24–32, figs. 3*).—This gives the results of official tests of 6 cows for advanced registration and also milk and butter fat records for 1 year of individual cows in 5 dairy herds. The production of butter fat by individuals ranged from 135 lbs. to 421 lbs., and by herds from 190 to 319 lbs.

On the influence of grooming cows and adding certain mineral substances to feeds upon the yield and quality of the milk, LIPSCHITZ (*Nederland. Weekbl. Zuivelbereid. Veenteelt, 12 (1906), No. 11; abs. in Milchw. Zentbl., 2 (1906), No. 10, p. 462*).—The thorough cleaning of cows did not result in an increased yield of milk, as was found in Russian experiments (E. S. R., 17, p. 72). The feeding of 50 gm. of salt per cow daily was found to be excessive. The digestion of the animals was unfavorably influenced and

the ash content of the milk was increased. An allowance of 15 to 30 gm. is recommended. The feeding of 50 gm. of calcium phosphate in the form of bone meal decreased rather than increased the yield of milk. The ash content of the milk was increased.

Some experiment station work relating to the production and sale of pure milk, H. W. LAWSON (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1905, pp. 281–301*).—A review of station publications relating to sanitary milk production.

Inspection of dairies, C. HARRINGTON (*Ann. Rpt. Bd. Health Mass., 37 (1905), pp. 519–526*).—This is a report on the inspection of 2,151 dairies in Massachusetts during the 7 months ended September 30, 1905. Of the whole number of dairies inspected 1,720 were found to possess one or more objectionable features. The nature of these defects is briefly set forth.

Studies of market milk, W. A. STOCKING, Jr. (*Connecticut Storrs Sta. Rpt. 1905, pp. 164–214*).—The author has been studying for 2 years the sanitary condition of milk as produced and delivered by individual dairymen. In this paper are given the detailed results of numerous examinations of milk as delivered by 30 producers from September to March to a shipping station to be sent to Providence, Rhode Island.

The composition of the milk was found to be satisfactory. In other respects, the milk was considered very poor. "In fact it was found to be impossible to keep most of this milk sweet long enough to get it to the city even when placed in cars and iced as soon as received." In general the dirt content increased with the number of bacteria present. The milk examined was considered by the author as representing about the poorest quality produced in Connecticut.

Milk hygiene investigations, W. RULLMANN and R. TROMMSDORFF (*Arch. Hyg., 59 (1906), No. 3, pp. 224–265*).—This is a detailed account of investigations on the presence and significance of leucocytes and streptococci in milk. Brief reference has already been made to other articles by these authors in which the substance of the work was reported (E. S. R., 17, pp. 1007, 1008).

Milk contamination in collection and transit, J. S. LLOYD (*Vet. Rec., 19 (1906), No. 941, pp. 41–44*).—This is an abstract of an address in which were discussed methods of examining milk for impurities and the sources, effects, and means of prevention of its contamination.

Fecal material and bacteria in milk, J. WEBER (*Chem. Ztg., 30 (1906), No. 84, pp. 1035, 1036*).—In an address the author stated that only 10 per cent of cow manure added to milk can be recovered as dry insoluble matter. Means of securing milk with a minimum amount of bacterial and other contaminations were discussed.

Destruction of tubercle bacilli in the manufacture of milk powder by the Just-Hatmaker method, W. HOFFMANN (*Arch. Hyg., 59 (1906), No. 3, pp. 216–223, fig. 1*).—The results of inoculation experiments with guinea pigs showed that bovine tubercle bacilli are destroyed in the manufacture of milk powder by the Just-Hatmaker process.

A contribution to the question of feeding young animals raw v. boiled milk, R. EICHLOFF (*Milchw. Zentbl., 2 (1906), No. 10, pp. 458–462*).—A comparative study was made of the bones and blood of 8 puppies, 4 of which were fed raw milk and 4 milk which had been boiled for 15 minutes. While the results of the experiments were not considered very conclusive they seemed to indicate certain abnormal changes in the tissues of the puppies fed boiled milk.

An effort was made to determine if injurious substances are developed in the process of heating. Milk heated for 150 minutes over a naked flame showed the presence of 0.0126 per cent of ammonia. The same process resulted

also in the production of 0.000204 gm. of sulphuric acid in 100 cc. of milk. Phosphorus was also detected in the distillate from heated milk, but whether in the free form or as phosphoric acid was not ascertained.

On the phosphorus and calcium of human milk, A. W. SIKES (*Jour. Physiol., 34 (1906), No. 6, pp. 464–480, figs. 5*).—The author analyzed 79 samples, finding P_2O_5 during the first 14 days after the commencement of lactation to vary from 0.0140 to 0.0522 per cent and to average 0.0297 per cent, and the calcium to average 0.0301 per cent. The nonproteid phosphoric acid averaged 0.0169 per cent and the proteid phosphoric acid 0.0124 per cent. The ratio of the proteid phosphoric acid to the total phosphoric acid averaged 42.3. Assuming that the proteid in human milk averages 2 per cent, the phosphoric acid in this would be 0.62 per cent. The calcium combined with the proteid bore a ratio to the total calcium of 84:100. Calcium averaged 1.06 per cent of the total proteid.

Infantile mortality and goats' milk, W. WRIGHT (*Lancet [London], 1906, II, No. 18, pp. 1212, 1213*).—Among the reasons offered in this effort to show that goats' milk is superior to cows' milk for infant feeding are the greater ease with which goats' milk is digested, the natural cleanliness of the animals, and their practical immunity toward tuberculosis.

Feeding experiments with perhydrase milk, A. BÖHME (*Deut. Med. Wchnschr., 32 (1906), No. 43, pp. 1729–1733*).—The results of a number of tests indicated that milk treated with hydrogen peroxid according to the method of Much and Römer is suitable for feeding infants over 3 months of age. The superiority of the perhydrase milk over boiled milk was indicated by a greater increase in weight and the rapid disappearance of rachitic symptoms.

Some bacteriological dairy investigations, H. WEIGMANN, T. GRUBER, and H. HUSS (*Milchw. Zentbl., 2 (1906), No. 10, pp. 441–451, pls. 2*).—Bacteriological investigations were made of several faulty cheeses, a sample of abnormal cream, and bitter milk. The organisms considered responsible for the troubles were isolated from the different samples. A brown coloration in the interior of 2 types of cheese was attributed to the effect of *Bacterium casei fusci*, the growth of which is illustrated in plates.

The application of mechanical refrigeration to ice cream manufacture, J. H. HART (*Jour. Franklin Inst., 162 (1906), No. 5, pp. 397–403*).—A description of the methods employed in the manufacture of ice cream.

Report of the jury on the examination of pasteurizing apparatus at the third international dairy exposition at Brussels, 1904 (*Rapport du jury chargé d'examiner les appareils de pasteurisation ayant participé au concours organisé à l'occasion de la 3me Exposition Internationale de Laiterie à Bruxelles, Avril 1904. Brussels: E. Daem, 1906, pp. 70, figs. 29*).—This gives the results of tests of 11 pasteurizers.

Our butter analysis (*Country Life [London], 20 (1906), No. 515, pp. 689, 690*).—The editor of *Country Life* secured 1 sample each of what was believed to be the best Danish, the best Italian, the best Britanny, and the best English butter procurable in London, marked the samples respectively A, B, C, and D, and submitted them to F. J. Lloyd for examination. The analyses are as follows:

Analyses of butter.

Source.	Water.	Fat.	Casein.	Salts.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Danish	12.55	84.91	0.71	1.83
Italian	14.64	82.97	1.39	1.00
Britanny	13.64	84.88	.86	.62
English	11.99	87.03	.72	.26

The results of examinations made when the samples were first obtained and after 16 days, including the bacteriological data, were considered decidedly in favor of the English butter. Notwithstanding the low percentage of salt, this showed superior keeping qualities and was pronounced the cleanest and best sample.

Annual report of the experiment station for cheese making at Lodi, 1905, C. Besana et al. (*Ann. R. Staz. Sper. Caseif. Lodi, 1905, pp. 127*).—This contains a review of the work of the station during the year, a report of experiments in feeding skim milk to pigs, investigations on the ripening of cheese, analyses of rice products, a study of the potable waters of Lodi, and other articles.

In the investigations on cheese ripening by G. Cornalba, chemical analyses were made of Grana and Provoloni cheese. The results showed that in Grana cheese, ripening proceeds from the center outwards. In the ripened cheese only a small quantity of the casein is in a soluble form. The quantity of ammonia which is formed from the soluble casein, however, is considerable and this represents a considerable portion of the soluble nitrogen. The volatile acids are represented principally by caproic, acetic, and butyric acids, the latter predominating. The fat does not undergo appreciable changes. The volatile fatty acids are not saponified by the ammonia. In Provoloni cheese as in Grana considerable ammonia is formed from the soluble casein. In the ripened cheese two volatile acids are present—caproic and butyric. The process of ripening is also centrifugal.

On the influence of the addition of different substances to cows' milk upon the coagulation of the milk with rennet, C. Smeliansky (*Arch. Hyg., 59 (1906), No. 3, pp. 187–215*).—The literature of this subject is reviewed and experimental work reported.

Either the time required for coagulation or the character of the coagulum was affected by pasteurization, dilution of the milk with water, the addition of mucilaginous substances obtained from grains, and the addition of various salts, including sodium carbonate, sodium chlorid, potassium carbonate, and calcium chlorid. The different kinds of sugars tested, on the contrary, were without influence.

The action of rennet on casein, E. Petry (*Beitr. Chem. Physiol. u. Path., 8 (1906), No. 8–10, pp. 339–364*).—The author discusses briefly some of the literature of this subject and reports studies of the chemical properties of the cleavage products resulting from the action of rennet, the conditions of rennet action, the effect of rennet upon various proteids, and the relation of milk coagulation to the proteolytic action of the rennet ferment. Two distinct actions of rennet are recognized, one resulting in the formation of paracasein, and the other proteolytic.

Nature and conditions of rennet action, K. Spiro (*Beitr. Chem. Physiol. u. Path., 8 (1906), No. 8–10, pp. 365–369*).—The author discusses the digestive action of rennet upon casein solutions.

The national fruit and cider institute (*Nat. Fruit and Cider Inst., Long Ashton* [*Eng.*], *Rpt. 1906, pp. 32*).—In order to determine whether apples are sufficiently ripe for cider making it is suggested by F. J. Lloyd that a test be made for starch, which is absent in mature apples.

B. T. P. Barker reports analyses of ciders made from different varieties of apples and discusses the characters of the fruit which are most valuable for cider making. The factors considered of primary importance are the characteristic flavor of the variety and the rate of fermentation of the juice. Other characters which are of minor importance only are the chemical composition of the fruit, the yield of juice, the characters of growth, such as the abundance

and yield of fruit, and the season of flowering and ripening. Extensive tests have been made of numerous varieties of apples for cider making. The results indicate that a particular variety yields the same type of cider regardless of the source of the apples. Very few varieties are believed to possess all the characteristics necessary for the production of first-class cider. Experiments in blending were also conducted.

On the cause of the production of aldehydes in wine and the quantity which is present in certain wines of Tuscany, N. Passerini (*Staz. Sper. Agr. Ital., 39 (1906), No. 3, pp. 221–240*).—Aldehydes are considered a normal product of alcoholic fermentation. They are produced by aerobic ferments rather than anaerobic. The amount of aldehydes in wine is increased by the treatment of the must with sulphites. The presence of oxydase derived from *Botrytis cinerea* is not believed to be a cause of the formation of aldehydes.

In the wines of Tuscany the aldehyde content varied from 1 to 60 mg. per liter. Wines with a high alcoholic content contained usually the largest amount of aldehydes and white wines contained more than the red.

On the influence of temperature on the odor and taste of wine, J. Wortmann (*Landw. Jahrb., 35 (1906), No. 5, pp. 741–836*).—The temperature of wine is considered of considerable importance in judging, inasmuch as it has an influence upon the odor and taste of the wine. Numerous experiments were conducted for the purpose of determining the most favorable temperature for testing a considerable number of wines.

Clarification of sugar with iron compounds, H. C. P. Geerligs (*Meded. Proefstat. Suikerriet West-Java, 1906, No. 92, pp. 8*).

The inorganic constituents of cane juice in their relation to the sugar content of the juice, H. C. P. Geerligs (*Meded. Proefstat. Suikerriet West-Java, 1906, No. 93, pp. 33*).

Modern soaps, candles, and glycerin, L. L. Lamborn (*New York: D. Van Nostrand Co.; London: Crosby, Lockwood & Son, 1906, pp. XX + 688, figs. 225*).—This is "a practical manual of modern methods of utilization of fat and oils in the manufacture of soap and candles, and of the recovery of glycerin."

VETERINARY MEDICINE.

Annual report on investigations in the field of veterinary medicine, Ellenberger et al. (*Jahresber. Vet. Med., 25 (1905), pp. IV + 436*).—As in previous summaries of this series the authors have brought together abstracts of all veterinary literature of the year available to them. The literature is classified as usual according to the nature of the articles and the volume is provided with a complete name and subject index.

Annual report of veterinary department of station, J. C. Robert (*Mississippi Sta. Rpt. 1905, pp. 25, 26*).—A brief account is given of the work of the station on Texas fever, blackleg, anthrax, glanders, milk fever, and peavine disease.

Some complaints had been received that peavines occasionally poison or cause the death of cows. An examination of cow peas failed to show the presence of any poisonous substance.

Second report of the Wellcome research laboratories at the Gordon Memorial College, Khartoum, A. Balfour (*Khartoum: Dept. Ed., Sudan Govt., 1906, pp. 255, pls. 21, figs. 106*).—The larger part of this report is occupied with accounts of recent researches in the Wellcome laboratories on mosquitoes, tsetse flies, and other biting insects, various insect pests injurious to cultivated crops, and on trypanosomiasis and other diseases of man and animals in the Anglo-Egyptian Sudan.

In view of the proposed extension of irrigation work in the neighborhood of Khartoum the author advises that a dry belt 1 mile in width be preserved around the city in order to prevent the infestation of the city with mosquitoes. Notes are given on methods of destroying mosquitoes in pools, swamps, houses, and ships. The different species of tsetse flies are described with particular reference to their agency in transmitting blood parasites. An account is also presented of plant lice on sorghum and other plants and of locusts, species of Simulium, horse flies, and other injurious insects.

Hæmogregarina balfouri is reported as occurring in the jerboa and other mammals. A report is also made on the prevalence of trypanosomiasis in cattle, mules, and human beings and on blood examination and related subjects.

The report of the chemical laboratory (pp. 205–244) is noted elsewhere in this issue.

Tuberculosis of the food-producing animals, D. E. Salmon (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 38, pp. 99, pls. 9*).—The author has presented a discussion of the chief problems relating to tuberculosis. Statistics are given on the prevalence of tuberculosis in the United States and Europe and the extent of losses from this disease. The cause and pathology of tuberculosis are considered in detail and notes are given on the tuberculin test.

Particular attention is devoted to a consideration of the intertransmission of tuberculosis between man and animals and recent experiments in immunization of cattle to the disease. The author concludes that bovine tuberculosis may be communicated to human beings, particularly children, and that man may also become infected from tuberculous hogs, sheep, goats, and other animals but not from poultry. It is believed that human tuberculosis is transmissible to animals only in a relatively small percentage of cases.

With reference to the immunization of cattle to tuberculosis, the author calls attention to the fact that great progress has been made along this line, but that the results are not as uniform as could be desired. The methods now in use, however, are capable of great improvement.

The State may aid materially in the eradication of tuberculosis by requiring a tuberculin test, inspection of all slaughtered animals, and the payment of a reasonable compensation. Some help may also be derived from the establishment of breeding herds known to be free from the disease and maintained in healthy surroundings.

The living sources of tuberculosis, Cadéac (*Jour. Méd. Vét. et Zootech., 57 (1906), July, pp. 394–399*).—While many means are known by which tuberculosis may be transmitted from one animal to another, it is impossible under ordinary circumstances to transmit the disease to any serious extent without a close association of affected and healthy animals. Such close contact makes it possible for contagion to be spread through either the respiratory or digestive organs.

Notes are given on the usual course of tuberculosis in cattle, goats, dogs, rabbits, sheep, and birds, with special reference to the stage of the disease when it is most infectious.

The avenues of infection with tuberculosis and the means of defense on the part of the organism, A. Calmette (*Rev. Sci. [Paris], 5. ser., 6 (1906), No. 9, pp. 257–265*).—The controversy concerning the usual mode of infection with tuberculosis is critically considered.

In the author's opinion, the most frequent source of infection is through the alimentary tract, especially the intestines. Tubercle bacilli introduced into the alimentary tract may penetrate through the walls of the intestines without leaving any lesion, and after they reach the lymphatic vessels they may be sur-

rounded by leucocytes and carried by these corpuscles into various parts of the body. The author believes that nearly all internal localizations of tuberculous infection are of intestinal origin.

Resorption of dead tubercle bacilli, A. MARMOREK (*Berlin. Klin. Wchnschr., 43 (1906), No. 36, pp. 1179, 1180*).—Different samples of cultures were subjected to temperatures ranging from 100 to 120° C. for periods of 1 to 60 minutes, and experiments carried out on guinea pigs and rabbits with relatively large quantities of dead tubercle bacilli showed conclusively that these bacilli may be absorbed by the experimental animals without the production of an abscess at the point of inoculation.

In order to secure a resorption of the dead tubercle bacilli without the formation of an abscess it is necessary to carefully pulverize the material before making an injection, as if relatively large masses of dead tubercle cultures are deposited under the skin in experimental animals an abscess is sure to follow.

In general it is found that rabbits possess a much more striking power of absorbing the bodies of tubercle bacilli than guinea pigs, and therefore will endure a large quantity of tubercle bacilli without showing the development of extensive inflammation or abscesses.

The action of bovine and human tubercle bacilli upon anthropoid apes, E. VON DUNGERN and H. SCHMIDT (*Arb. K. Gsndhtsamt., 23 (1906), No. 2, pp. 570–587*).—A series of inoculation experiments was carried out upon anthropoid apes, during which tubercle bacilli of human and bovine origin were used.

It appeared that the bovine bacilli were fully as virulent for the gibbon as human tubercle bacilli. Since the gibbon is considered as very closely related to man, it is argued that the results obtained may be looked upon as applicable also to man. Further experiments will be made along this line. When human tubercle bacilli were fed to gibbons, tuberculous foci appeared in the lungs, while after feeding bovine bacilli the alimentary tract and mesenteric glands were chiefly affected.

Protective vaccination against Texas fever, GRAFFUNDER (*Berlin. Tierärztl. Wchnschr., 1906, No. 36, pp. 656–659*).—As a result of the study of this disease in Germany, the author concludes that a complete immunity can not be produced by 1 or 2 vaccinations.

It is recommended that the vaccination be done on calves from 6 weeks to 1 year old and preferably during the winter. The size of the vaccine dose varies from 5 to 15 cc.

Piroplasma bigeminum in Texas fever in Lolland, A. F. FOLGER (*Maanedskr. Dyrlæger, 18 (1906), No. 5, pp. 230–235, fig. 1*).—Historical references are made to the literature of this subject with particular reference to the biology of the blood parasite and the use of hemoglobin in treating the disease.

Redwater in cattle, G. H. WOOLDRIDGE (*Agr. Students' Gaz., n. ser., 13 (1906), No. 1, pp. 2–12, pls. 3*).—The author describes in some detail the symptoms and post-mortem appearances which may be observed in acute and chronic cases of Texas fever. The means of transmission as well as curative and preventive treatments are also discussed.

The cattle tick in its relation to southern agriculture, A. MAYER (*U. S. Dept. Agr. Farmers' Bul. 261, pp. 22*).—In the author's opinion the chief difficulty in the way of improving the cattle industry of the South is the presence of the cattle tick. It is recognized that the cattle tick on the range country is by no means so serious as on improved pastures in which the infestation has become continually worse.

Attention is called to the injury to cattle from parasitism with ticks. Aside from the agency of these pests in transmitting Texas fever, beef cattle badly

infested with ticks do not reach the size which they otherwise would attain. Milch cows sometimes abort as the result of excessive infestation or occasionally do not breed until 3 or 4 years old.

From a practical standpoint, the author finds some objection to the method of feed-lot rotation, but believes that the method of starving out the ticks is practicable and promises results.

Rinderpest in South Africa, G. Turner (*Jour. Trop. Vet. Sci., 1 (1906), No. 3, pp. 269–283*).—A brief account is presented of different methods which have been used in immunizing cattle against rinderpest.

Some of these methods suffer from the disadvantage that the immunity produced is of very short duration. In order to bring about a longer immunity, the author used serum from animals which have been repeatedly hyperimmunized. Reports have been received regarding the use of this serum on 108,000 cattle, in which the loss amounted to 1.3 per cent.

The importance of forage in the distribution of anthrax, P. Spissu (*Staz. Sper. Agr. Ital., 39 (1906), No. 3, pp. 213–220*).—In preventing the distribution of anthrax it becomes necessary to study carefully all possible means for the diffusion of this disease. According to the author's experiments, it is impossible for plants which grow in the soil over the buried carcasses of animals dying of anthrax to carry the contagion. Forage, however, which in any way becomes contaminated may serve as a means of transmitting the disease, especially in the presence of a lesion in the digestive tract.

Inoculation experiments with Actinomyces asteroides in guinea pigs, H. Nakayama (*Arch. Hyg., 58 (1906), No. 3, pp. 207–312, pls. 4*).—The literature relating to the biology and forms of actinomyces is critically discussed in connection with numerous bibliographical references.

The author undertook an elaborate series of experiments for the purpose of studying the biological forms under which actinomyces occurs, and also the effect of actinomyces on guinea pigs with particular reference to the problem of supersensitiveness. In the course of the experiments it was found that guinea pigs will endure a single inoculation with enormous quantities of actinomyces. In fact, the organism appears not to be able to cause death with acute symptoms of infection from the first inoculation. About 1 week after the first inoculation, however, a condition of excessive susceptibility to the disease is noted, and any further inoculation at this time results in the very rapid spread of the infection, and death. This stage of supersensitiveness persists for only 3 weeks, after which the animal returns to a normal condition, provided no second inoculation is given during the period.

The author believes that the condition of supersensitiveness observed in his experiments is sometimes present in the case of infection with tuberculosis, and may be held to account for the failure of immunization experiments in such cases.

Septic pneumonia of calves, Rühm (*Wchnschr. Tierheilk. u. Viehzucht, 50 (1906), No. 36, pp. 702–705*).—The author observed 15 calves so badly affected with septic pneumonia that at the age of 3 months they were no larger than they should have been at 1 month. The 15 calves were given the serum treatment, and all recovered entirely. In addition a young calf, not affected, was vaccinated and appeared to be rendered immune to the disease.

Notes are given on the symptoms and pathology of the disease.

Infectious catarrhal bronchitis and pneumonia in cattle, Martens (*Berlin. Tierärztl. Wchnschr., 1906, No. 36, pp. 655, 656*).—Cattle are not commonly supposed to be affected with an infectious pneumonia similar to that which prevails in the horse. The author, however, observed a number of cases and made a study of the symptoms and course of the disease.

The symptoms were very similar to those of pneumonia in the horse, including fever and a catarrhal discharge. The mild cases ran a course of 6 to 8 days, while in more serious cases the disease persisted for 4 to 6 weeks. A favorable outcome took place in all cases, but 1 animal was slaughtered for further observation. In this case there was a pronounced hepatization of the lungs, and the bronchi were filled with a catarrhal secretion.

The symptoms in general might cause a supposition of pleuro-pneumonia, but the incubation period was not longer than 8 days, while in pleuro-pneumonia it is ordinarily several weeks.

The treatment of infectious vaginal catarrh of cattle by means of salves, SCHWEIKERT (*Berlin. Tierärztl. Wchnschr., 1906, No. 35, pp. 639, 640, fig. 1*).—The method of treating this disease, previously recommended by the author, consists in the local application of antiseptic salves by means of a syringe especially designed for this purpose. A number of veterinarians suggested the desirability of having a syringe constructed in such a way as to be separable into two parts for greater convenience of carrying. This has been done, and the apparatus promises to be more convenient than a solid syringe.

Epizootics of cowpox among dairy cows, FRÉGER (*Jour. Méd. Vét. et Zootech., 57 (1906), July, pp. 385–392, fig. 1*).—While cowpox is a benign disease and does not lead to serious results with the cows, it may nevertheless cause great annoyance in outbreaks of unusual extent. A number of such outbreaks are described by the author.

It was found that if the ordinary vaccine obtained from pustules on the udder was used in vaccinating cows in the region of the perineum the pustules rapidly disappeared on the udder and the cows became noninfectious. The author believes, therefore, that the distribution of the disease may be rapidly checked by adopting this method of treatment.

Warble flies and their control by law, R. OSTERTAG (*Ztschr. Fleisch u. Milchhyg., 16 (1906), No. 12, pp. 407–413*).—The life history of *Hypoderma bovis* is described in considerable detail and notes are given on the injury caused by this pest to cattle hides. It is estimated that this insect causes in Germany a loss of 6,000,000 to 8,000,000 marks.

Tanners have suggested the desirability of a law compelling stock raisers to remove and destroy all larvæ of warble flies found in the skin of cattle. In a few instances where this has been tried, particularly in Ireland, good results have been observed.

Trephining the skull for Cœnurus cerebralis bovis, F. BRAUN (*Wchnschr. Tierheilk. u. Viehzucht, 50 (1906), No. 24, pp. 461–463*).—Some unsatisfactory experiences in operating to remove this parasitic worm are related by the author.

In one case the animal showed violent cerebral symptoms after an apparently successful removal of the parasite and had to be killed. The author, therefore, recommends against such operations since the parasite is usually located deep in the tissue of the brain and since frequently there may be several cysts in the same brain.

A disease of sheep in Ayrshire (*Jour. Bd. Agr. [London], 13 (1906), No. 5, pp. 291–293*).—Parasitic gastritis appears in sheep during the months of May and June, attacking most frequently ewes with young lambs. The first symptoms observed by the attendant are a lagging behind of affected sheep, a disinclination to eat, and suspension of rumination. In many cases the animals are found dead or die suddenly after the symptoms appear. Occasionally the affected sheep rally from the first attack, but the disease reappears with greater severity during the second season. The losses are estimated at from 3 to 10 per cent.

Affected animals must be considered as a source of infestation and should be removed from the rest of the flock. Some benefit is also derived from administering a tonic.

The microscopic changes in the nervous system in cases of chronic dourine as compared with those found in sleeping sickness, F. W. MOTT (*Proc. Roy. Soc. [London], Ser. B, 78 (1906), No. B522, pp. 1–12, pls. 4*).—In chronic dourine the nerve cells of the spinal cord show decided color changes, and the blood vessels exhibit evidence of inflammation, with small hemorrhages. The nerve tissue of the spinal cord becomes infiltrated with lymphocytes and all blood vessels are surrounded with small round cells. These pathological conditions are compared with those which are observed in sleeping sickness.

The destruction of Trypanosoma brucei in the spleen, A. RODET and G. VALLET (*Compt. Rend. Acad. Sci. [Paris], 142 (1906), No. 22, pp. 1229–1231*).—An experimental study was made of this disease in dogs and rats. The authors found that the blood parasites are rapidly destroyed in the spleen. In fact, the spleen appears to be the most important organ in this work, although it is assisted to some extent by other organs belonging to the lymphatic system.

The treatment of trypanosomiases with benzidin colors, M. NICOLLE and F. MESNIL (*Ann. Inst. Pasteur, 20 (1906), No. 6, pp. 417–448*).—Recently much interest has arisen in the study of the effect of various dyes upon blood parasites, particularly those of nagana, surra, and mal de caderas. The authors have made an elaborate study of the chemical composition and action of thirteen dyes belonging to the benzidin group.

The authors worked with mice which were first inoculated with one or the other of the diseases mentioned above and then given hyperdermic injections of one per cent solution of the dyestuffs in doses of one c. c. It was found that dichlorobenzidin and tolidin after one injection caused the total disappearance of the blood parasites in many cases. The action of the coloring matters was not the same when used in treating the three diseases.

Diseases caused by palisade worms in horses, F. GLAGE (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 1 (1906), No. 4–5, pp. 341–375*).—A careful study was made of the anatomical characters and biology of *Sclerostomum edentatum* and *S. bidentatum*.

These worms in various stages are frequently found together in the same horse or colt, and for this reason some difficulty of identification is experienced, particularly in the larval stages. The author believes, however, that the 2 species are distinct, and offers good evidence as a basis for that belief. The parasites in question may appear in various tissues of the host, causing injury by direct removal of the blood, a production of hemorrhages, and mechanical injuries, particularly in the peritoneum. Occasionally chronic cases of general cachexia are observed as a result of infestation with these parasites.

Protective vaccine against rabies, O. HELLER (*Die Schutzimpfung gegen Lyssa. Jena: Gustav Fischer, 1906, pp. 142*).—The literature relating to rabies is critically dscussed in connection with an extensive bibliography which occupies pages 92–142.

The author was chiefly concerned during his investigations in determining the cause of rabies as far as possible, and in obtaining a nonvirulent vaccine. As a result of these studies the conclusion is reached that rabies is not a bacterial disease. It appears that immunity to rabies may be brought about by the use of the material which constitutes the organism of rabies, together with the toxic substances which are produced in animals as a result of infection with rabies.

The methods heretofore used in obtaining vaccines for the control of rabies have not made it possible to obtain a vaccine which was not infectious. This has been accomplished, in the author's opinion, by the method and apparatus used by Macfadyen. After the virus has been treated with the fine sand used in this method, it loses its infectiousness, but still remains toxic, and is effective in producing immunity to rabies. Its effectiveness was shown by the author in a number of experiments on rabbits and dogs.

RURAL ENGINEERING.

Practical information for beginners in irrigation, S. FORTIER (*U. S. Dept. Agr., Farmers' Bul. 263, pp. 40, figs. 25*).—The purpose of this bulletin is to give new settlers in the arid region, particularly those coming from the humid sections of the East, such information as will enable them most successfully to adapt themselves to their changed conditions.

The writer discusses first the selection and location of an irrigated farm, with particular reference to the character and depth of soil and its topographical features, and then takes up the question of water supply, on which helpful suggestions are given as to the legal procedure necessary in the acquirement of a water right. Farm ditches are considered with respect to their capacity, form, grade, location, and the simple structures necessary.

Preparation of land for irrigation under the various systems and for various crops is described in detail, after which the methods of irrigation of the several crops receive attention. Following these, hints are given as to the best means of preventing waste of water and as to the right quantity to apply.

Drainage is advised as a means of combating most of those evils arising from rise of ground water, but economy in use of water and thorough cultivation are likewise recommended.

Reading courses in irrigation, E. MEAD (*California Sta. Circ. 20, pp. 7*).—In this circular a course of study in irrigation is outlined for the university extension in agriculture, Berkeley, Cal. A list of questions on irrigation practice and institutions is given, together with an outline of the regular course in irrigation engineering at the University of California.

Drainage investigations, C. G. ELLIOTT (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1905, pp. 197–210*).—The studies and experiments included in these investigations may be classified as follows:

"(1) Work connected with improving small natural streams and providing sufficient and adequate artificial outlets for the drainage of large areas of fertile land hitherto deficient in natural drainage which is projected and executed under the provisions of State drainage laws.

"(2) The protection of overflowed lands bordering alluvial streams, and their interior drainage after protection works have been constructed.

"(3) The solution of problems connected with the underdrainage of soils of widely different character and subject to diverse climatic conditions.

"(4) The protection and subsequent management of tidal lands, which when thus improved may be valuable for agriculture.

"(5) The drainage of lands in the arid region which under irrigation have become saturated and in consequence unproductive, and the prevention and removal of alkali occasioned by such saturation."

Of these various lines of investigation only those features of the work which are perplexing and difficult for the landowners to carry out for themselves are investigated. In some instances this Office has assisted engineers in perfecting plans and in uniting the people to carry them out. In other cases the Office has gone further and made preliminary drainage surveys and general plans for the

draining of land in cooperation with the owners or counties where there was not sufficient understanding of the matter to either make the surveys or develop a plan of work.

Careful investigation has been made of drainage in connection with the construction of levees and the interior ditching and draining of protected land, an instance being investigations in the valley of Neosho River, Kansas. The erosion of hill lands, which is a constant menace to the stability and continued productiveness of farms, has received attention, and experiments in the drainage of a tract of such lands in Georgia have resulted in the complete restoration of their original value.

The increased tendency toward intensive production is directing the attention of owners of land in the Middle West and South to the attainment of this end by the aid of underdrainage. Difficulties have been encountered, however, in the Red River Valley of Minnesota and the Dakotas, where it is now conceded that more complete drainage than that offered by surface drainage is desirable, but where the probable efficiency of tile drains in such soils and in a climate where the ground freezes to a depth of 6 ft. is problematic. To secure information on these questions this Office proposes to establish experimental plats in the localities named, where drain tiles will be laid in various ways to determine the particular method of use giving the best results.

The prevention of damage by rise of alkali in the irrigated soils of the West is being experimented upon in Utah, Washington, and Nebraska, where such work as has already been done has shown uniformly beneficial results.

Preliminary investigations have also been made in the Kankakee Valley, Indiana, in the examination of the country and collection of information bearing upon the problems encountered in the reclamation of the Kankakee Marsh.

Report of progress of stream measurements for the calendar year 1905 (*U. S. Geol. Survey, Water-Supply and Irrig. Papers Nos. 165–178, pp. 155+166+101+128+164+153+116+113+283+105+133+194+142+273+250*).—The report consists of 14 papers published separately as parts 1 to 14. The parts cover the following subjects:

Pt. 1, Atlantic Coast of New England Drainage, H. K. Barrows and John C. Hoyt; pt. 2, Hudson, Passaic, Raritan, and Delaware River Drainages, R. E. Horton, N. C. Grover and J. C. Hoyt; pt. 3, Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin River Drainages, N. C. Grover and J. C. Hoyt; pt. 4, Santee, Savannah, Ogeechee, and Altamaha Rivers and Eastern Gulf of Mexico Drainages, M. R. Hall and J. C. Hoyt; pt. 5, Ohio and Lower Eastern Mississippi River Drainages, M. R. Hall, F. W. Hanna, and J. C. Hoyt; pt. 6, Great Lakes and St. Lawrence River Drainages, R. E. Horton, F. W. Hanna, and J. C. Hoyt; pt. 7, Hudson Bay and Upper Eastern and Western Mississippi River Drainages, F. W. Hanna and J. C. Hoyt; pt 8, Missouri River Drainage, C. C. Babb, M. C. Hinderlider, and J. C. Hoyt; pt. 9, Meramec, Arkansas, Red, and Lower Western Mississippi River Drainages, M. C. Hinderlider, J. M. Giles, and J. C. Hoyt; pt. 10, Western Gulf of Mexico and Rio Grande Drainages, T. U. Taylor and J. C. Hoyt; pt. 11, Colorado River Drainage above Yuma, M. C. Hinderlider and G. L. Swendsen; pt. 12, The Great Basin Drainage, M. C. Hinderlider, G. L. Swendsen, and H. Thurtell; pt. 13, Great Basin and Pacific Ocean Drainages in California, and Colorado River Drainage below Gila River, W. B. Clapp and J. C. Hoyt; pt. 14, Columbia River and Puget Sound Drainage, D. W. Ross, J. T. Whistler, and T. A. Noble.

Geology and water resources of Owens Valley, California, W. T. LEE (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 181, pp. 28 + VI, pls.*

6).—A report of field studies made in the region including Owens Valley, part of Mono Lake and Salt Wells Valleys, and the slopes of the adjoining mountain ranges. The conclusions bearing upon irrigation are as follows:

"Owens Valley is a barren desert except where it is reclaimed by the use of water entering as mountain streams. Abundant rainfall occurs in the Sierra Nevadas, yielding for this valley an annual water supply of about 400,000 acre-feet. As the streams enter the valley they pass over unconsolidated detritus, into which much of the water sinks.

"Flowing wells occur in Owens Valley, but the limits of the district in which such wells are obtainable are undetermined.

"A large amount of underground water exists without hydrostatic pressure sufficient to produce flowing wells, but power for pumping this water can be produced from the mountain streams and transmitted to the valley at moderate cost.

"Owens Lake has been decreasing in volume for several years, with a corresponding increase in the density of its water. The salinity has reached a point at which the more insoluble salts precipitate. The change is probably due to the loss by evaporation of water diverted for irrigation and not to an increase in the aridity of the climate, as originally supposed.

"The proposed Owens Valley reservoir, being located in the fault zone at the base of the Sierra Nevada, would be especially liable to injury from crustal movements."

Turbine water-wheel tests and power tables, R. E. HORTON (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 180, pp. 131, pls. 4, figs. 33*).—A discussion of turbine water wheels, with special reference to their use as water meters. Various types of wheels are described, results of various tests are given, and manufacturers' tables of power, speed, and discharge are included.

The development of the test for the cementing value of road material, A. S. CUSHMAN (*Engin. Rec., 53 (1906), No. 25, pp. 760–762*).—A paper read before the American Society for Testing Materials.

The author reviews the earlier attempts to develop a test for the cementing values of the dust of abraded material. These first tests consisted in general of mixing road dust with water and molding the dough into small briquettes, which, after being dried, were tested to destruction by repeated impacts of a hammer weighing 1 kg. and falling 1 cm. Certain discrepancies having been found in the results obtained by this method, more care was taken in the mixing. It was found that the binding power could be increased by prolonged kneading, corresponding to the characteristics of dolomite in actual use, the binding power of which has been observed to increase after it has been on the road some time. Later still, a method of wet grinding was introduced, the "charge of rock dust being ground with approximately 20 per cent by weight of water in a ball mill for 3 hours." By this method the binding power was increased, confirming the idea general among road engineers that the more wet rolling to which the rock-road material can be subjected, the better the resulting road.

The latest developments in grinding are porcelain pebble mills which have been substituted for the heavy and cumbersome ball mills. A recent series of experiments has developed a field of investigation which, according to the author "promises to be of great interest both on the theoretical and practical sides." "It appears that the addition of lime or limestone will greatly increase the cementing value of an acidic rock like granite." The results that are shown in the table were obtained by mixing together limestone and granite rock powders of known cementing value and grinding the mixture with water.

Cement values of mixed rock dusts.

Limestone.	Granite.	Combination.
20	6	82
26	7	53
22	9	56
13	10	22
27	3	110
26	7	38

In the opinion of the writer, these results indicate that "the road builder should blend his material, so as to bring about the greatest amount of decomposition possible among the road particles on which he depends for the formation of the bonded surface of his road."

The construction of sand-clay and burnt-clay roads, W. L. SPOON (*U. S. Dept. Agr., Office Pub. Roads Bul. 27, pp. 19, pls. 4, figs. 5*).—This bulletin discusses the investigations made by the Office of Public Roads on the use of a mixture of sand and clay for the improvement of roads, and upon the utilization of burnt clay for road construction.

By the use of a proper mixture of sand and clay it has been found possible to construct roads through localities where the prevailing soil is either sand or clay or an objectionable mixture of both. These roads are well adapted for light traffic, are less noisy, less dusty, and more resilient than the average macadam road. The best sand-clay road is one in which the wearing surface is composed of sand, and in which the spaces between the particles are entirely filled with clay. Such a mixture is best secured by thoroughly mixing the right proportion of the two ingredients with water. In practice the clay is first spread on the road and the larger lumps broken up. The surface is spread with a few inches of sand immediately after a hard rain, and the mixture then thoroughly stirred by a turning plow or disk harrow. The cost of sand-clay roads varies with local conditions, but may be taken at $300 to $800 per mile, the character of the foundation, whether sand or clay, making no difference in the cost.

In the improvement of roads through "gumbo" soils of the Yazoo district of Mississippi, simple burning of the clay upon the road surface was resorted to. Wood, procured adjacent to the road, is used as fuel, 1 cord being required per 8 linear ft. of a 12-ft. road. After deeply plowing the road transverse furrows are formed, across which the wood is laid. Lumps of clay and more wood are piled on this. A third layer of wood parallel to the first is then put on and finally covered with a layer of finer clay to a depth of not less than 6 or 8 in. Fifteen to twenty flues are fired at once, and the process of combustion made as uniform as possible. After the burning process is complete, the material, which is entirely changed in character, having no tendency to form mud when wet, is rolled down and compacted, forming a road surface 6 to 8 in. in thickness.

The total cost per mile of such construction, as based on the experiments carried on, is $1,478. It is thought that any soil which bricks or clinkers at comparatively low temperature is suitable for the work. Roads constructed by this method are said to be successful so far and to sustain traffic in even the wettest weather.

Waterproof roads as a solution of the dust problem, D. MACKENZIE (*Engineer* [*London*], *102* (*1906*), *No. 2643, pp. 185, 186*).—A paper read before the British Asociation, York, 1906, in which the author discusses the question of obviating the dust nuisance.

After commenting upon the failure of the oil or tar treatment because of its short period of usefulness and objectionable features from the standpoint of

cleanliness, the author concludes that "the great mistake has been in the use of tar as it is usually sold. Much better results have been found where the tar is distilled, but what is required is the addition of some material that will toughen the tar in much the same way that pitch is toughened for insulating purposes."

The evolution of farm-implement investigations, C. J. Zintheo (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1905, pp. 211–223*).—The economic conditions under which the American farmer is placed necessitate the extensive use of labor-saving machinery. Notwithstanding the large investments in such machinery and farm implements, there is little available information on their utility and efficiency.

The author describes the implement-testing laboratories in the different countries of Europe, giving information on the methods pursued and results accomplished in such tests. Some needed investigations are then considered in the testing of tillage, seeding, and planting implements, of harvesting and thrashing machinery, and of the motive powers for farm use. In connection with the last named, the question of using alcohol for fuel is briefly touched upon.

In conclusion the author states that the needs of this country in farm-machinery investigations are somewhat peculiar. American inventors have developed and supplied the farmers with a great variety of machines, but little is known as to which of the various types will best meet the requirements of different soil and crop conditions. "Such investigations would also form the basis for the development of new types of machines with which to meet the requirements of modern methods of agriculture, and thus to increase the yield of crops and reduce the cost of production."

Instructions to engineers of timber tests, W. K. Hatt (*U. S. Dept. Agr., Forest Serv. Circ. 38, pp. 55, figs. 17*).—A manual for engineers engaged in the testing of timber. The instructions cover tests to determine "the relation between the physical characteristics of wood and the mechanical properties, and the effect of various technological operations upon them; to establish authoritative data for design; to collect data for the improvement of specifications for market products; to study the best methods of testing; and to determine what species may be used as substitutes for those now becoming scarce."

RURAL ECONOMICS.

Some present problems in agriculture, L. H. Bailey (*Congress of Arts and Science. Boston and New York: Houghton, Mifflin & Co., 1906, vol. 6, pp. 727–738*).—This is a paper read before the section of agriculture at the St. Louis Purchase Exposition in 1904.

The author discusses the technical problems of agriculture and the problems of adjustment to the affairs of our growing civilization. Chief among technical problems are discussed: Methods of feeding to increase the efficiency of farm animals, the breeding of animals and plants for the same purpose, and the business organization of the farm, or development of a farm plan.

"The greatest problems of American agriculture [however] are not the narrower technical ones, but the relations of the industry to economic and social life in general." Along this line, according to the author, education, cooperation, investment of capital, farm labor, making country life attractive, better schools, and the production of a more natural agricultural literature are problems which press for solution. Government aid as a means to the solution of these technical and economic problems of agriculture is advocated.

Agricultural development and the social welfare of the farmer, P. De Vuyst (*Rev. Gén. Agron., n. ser., 1 (1906), No. 6–7, pp. 305–319*).—The author

reviews the course of agricultural evolution that has taken place in Belgium during the past 20 years, and shows how the changes have operated to improve the moral and social welfare of the rural population.

Among the causes of improvement brought about by the department of agriculture and the organization of farmers into unions and mutual aid societies are mentioned the popularization of scientific agricultural knowledge, the use of commercial fertilizers, breeding of improved cattle, new processes in the manufacture of dairy products, feeding experiments with dairy cows, and the raising of crops adapted to local conditions. The results are shown in greatly increased products, which directly affect the economic well-being of the producers.

Improvement in the social welfare of farmers and farm laborers has been due to information imparted in popular form regarding domestic hygiene, to the beautifying of homes and home surroundings, to a better standard of living, to the improved relations between proprietors, tenants, laborers, and the general public, and to the more numerous opportunities for social intercourse afforded by the various rural organizations. The progress made in these directions is briefly noted not only for Belgium, but for many other European countries and the United States.

Besides copious notes referring to the literature of the subject an extended bibliography is appended.

The negro farmer, W. E. B. Du Bois (*Supplementary Analysis and Derivative Tables. Bur. of the Census [U. S.], 1906, pp. 511–579, maps 3*).—The author gives statistics relating to the number of farms operated by colored farmers in the United States in 1900, total acreage and acreage under crops, value of farm property, and the value of products raised, and discusses many other matters bearing upon the economic development of the race from 1865 to 1900.

Of the 746,715 farms operated by negroes, 21 per cent were owned entirely, 4.2 per cent were owned in part, and 716,514 were improved by buildings. They contained 38,233,933 acres, of which 23,362,798 acres, or 61 per cent, were improved. The total value of farms and improvements was $499,943,734, and the gross value of products raised in 1899 was $255,751,145. "The Southern States contain more than 98 per cent of all farms operated by negroes and more than 97 per cent of the total acreage of these farms."

Reasoning from these facts and figures and reviewing a detailed study of ownership county by county the author finds two kinds of conditions prevailing in the black farming belt: "In the one case . . . economic conditions are favorable and the negroes migrate to or remain in the region and enjoy there a fair degree of agricultural prosperity; in the other case the economic conditions are less favorable, but they render emigration difficult by providing little education for the negroes, and by a general resort to the crop-lien system, under which the acquisition of landed property by negroes is impeded by the high value of land."

Prussia and its agricultural relations, A. Meitzen et al. (*Der Boden und die landwirtschaftlichen Verhältnisse des Preussischen Staates. Berlin: Paul Parey, 1906, pts. 1, pp. XIV + 901, figs. 16; 2, maps 27*).—This publication consists of a series of papers by various authors giving statistical data and discussions which relate to the development of agriculture in Prussia.

The following topics are treated in Part 1: Progress in the knowledge of plant and animal nutrition; culture and use of field crops from 1878 to 1900; the development of agriculture since 1866; drainage, irrigation, and high-water protection; moor cultivation; vegetable, fruit, and grape culture; extent and management of forests; cattle breeding, improvement, and statistics; veter-

inary science; fishing and fish culture; and agricultural production, including detailed statistics on the yields of the most important products.

Part 2 consists of 27 colored maps illustrating the data contained in vols. 5–8 of this publication.

The development of agriculture for the five years 1901 to 1905 (*Jahresber. Landw. Kammer Wiesbaden, 1905, pp. 143–319*).—A report is given on the progress of agriculture in the district of Wiesbaden.

Statistics are presented and discussed relating to the population and the natural and economic conditions of crop production, including data on the production, transportation, and monthly and annual prices of the most important agricultural products, such as cereals, cattle, meat, milk, potatoes, butter, eggs, wine, fruit, etc., and the extent of the use of feeding stuffs and fertilizers. Data are also given on the selling and renting values of land; agricultural labor, legislation, schools, and research institutions; cooperative banking, credit, and insurance societies; farm management, breeding and improvement of farm animals, and the technique and profitableness of agriculture.

Crop Reporter (*U. S. Dept. Agr., Bur. Statis. Crop Reporter, 8 (1906), No. 6, pp. 41–48; 7, pp. 49–56*).—These numbers for October and November, 1906, contain in addition to the usual statistics on the yields and condition of crops in the United States and foreign countries the following special articles: Crop export movement, 1905–6; stocks of American cheese, Sept. 30, 1906; per capita consumption of rice; cotton area of British India for 1906–7 crop; rice in the Philippine Islands; the Australasian wheat crop; peanut imports; tobacco crop by types—average production in 1906; the beet-sugar crop; the hop movement in the United States, 1900–1906; and other topics of an agricultural nature.

Cotton movement and fluctuation, 1901–1906 (*New York: Latham, Alexander & Co., 1906, pp. 184, pls. 6*).—This publication contains detailed statistics and special articles relating to cotton production, consumption, manufacture, and prices in the chief markets of the world, but particularly with reference to the cotton industry in the United States. For the year ended August 31, 1906, a summary of our trade in cotton and cotton goods is given as follows: Total crop 11,345,988 bales, value $600,000,000; export trade 6,716,351 bales, value $400,000,000; southern consumption 2,398,404 bales, northern consumption 2,499,768 bales; value of manufactured cotton goods exported $53,000,000.

AGRICULTURAL EDUCATION.

Progress in agricultural education, 1905, A. C. TRUE (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1905, pp. 303–357, pls. 5*).—A review is given of the educational work of this Department in its relation to both American and foreign educational institutions, including brief accounts of the Second International Congress of Agricultural Education and the First International Congress of Agricultural Mechanics, both held at Liege, Belgium, in 1905. Attention is given to the educational work in 1905 of the Association of American Agricultural Colleges and Experiment Stations, and the progress along agricultural lines made by the agricultural colleges and by secondary and primary schools. The article also contains a course of study for rural schools, prepared by Prof. W. M. Hays for the National Educational Association. This course provides an articulated scheme for the consolidated rural school, the agricultural high school, and the agricultural college.

Statistics of land-grant colleges and agricultural experiment stations, 1905, MARIE T. SPETHMANN (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1905, pp. 153–186*).—These statistics relate to the courses of study at the agricultural colleges, number of students in attendance, value of permanent funds and equip-

ment, revenues for the year, etc.; and the lines of work and publications of the experiment stations, their revenues, additions to equipment, and classification of expenditures for the fiscal year.

The total number of institutions maintaining courses in agriculture is 63, with a total income in 1905 of $11,767,154.54. The total number of persons in the faculties of the colleges of agriculture and mechanic arts was 2,672, and in other departments 1,889, making a grand total of 4,561 persons in the faculties of the land-grant institutions. The enrollment of students in colleges for white persons was 53,518, and in colleges and schools for colored persons, 6,294.

The total number of experiment stations is 60, exclusive of substations, and of these 55 receive the benefit of the Hatch Act. The total income of these stations during 1905 was $1,515,734.47, of which $718,163.45 was received from the National Government. In addition to this, the Office of Experiment Stations had an appropriation of $177,500, including $15,000 each for the Alaska, Hawaii, and Porto Rico stations, $20,000 for nutrition investigations, $67,500 for irrigation investigations, and $5,000 for farmers' institutes. The stations employed 845 persons in the work of administration and inquiry, of whom 423 did more or less teaching in the colleges with which the stations are connected. During the year the stations published 403 annual reports and bulletins, which were supplied to over 731,000 addresses on the regular mailing lists.

School agriculture (*Agr. Gaz. N. S. Wales, 17 (1906), No. 9, pp. 905–910, figs. 6, dgm. 1*).—An account is given of the success attained by Mr. John Halsted, while teacher of the public school at Eglinton, in teaching elementary agriculture, horticulture, floriculture, arboriculture, and apiculture. The account includes an outline showing the methods employed, a weekly lesson from the program illustrating the correlation of practice and theory, and a syllabus of the two-year course.

Agriculture, a school subject, C. W. BURKETT (*Industrialist, 33 (1906), No. 6, pp. 83–90*).—Two reasons are given for considering agriculture a good subject to teach in schools, viz, that it affords in a preeminent way (1) a wide field for accurate, interesting, and uplifting knowledge, and (2) a wide field for doing. Agriculture is a cultural subject because it is "concerned with the highest truths that the mind can consider, namely, the laws of life, of growth, of heredity, of adaptation, of selection, of environment." It is also a practical subject because of the direct application of its principles to life and because it shows the relation between cause and effect.

Suggestions are given to the teacher for the use of the text-book in teaching agriculture, for written work in connection with the text-book work, and for experiments both at school and at the homes of the children.

Outline for instruction in elements of agriculture for the use of teachers in common schools, C. P. CARY (*[Wis. State Supt. Pub. Instr.] Bul. 13, pp. 24, figs. 2*).—The Wisconsin law of 1905 requiring the teaching of agriculture among the branches of study in public schools is interpreted, and an outline for this subject is given. It is recommended that agriculture be taught in the last half of the eighth year, and that nature study be given in all grades through general exercises and in connection with language exercises, geography, reading, and history.

The outline is divided into three parts: (1) Agriculture, including the soil, water and the soil, tilling the soil, soil enrichment, the plant, the leguminous plants, plant enemies, rotation of crops, selection of seed, the farm garden, weeds, and home and school garden; (2) farm animals, including care and feeding, type forms, and farm economics, and (3) farm poultry. A bibliography of reference books and bulletins on the topics mentioned in the outline is given.

Agriculture in rural schools, D. J. CROSBY (*Farmers Voice, 44 (1906) No. 20, pp. 7, 8, figs. 3*).—The writer discusses the trend in modern education toward concreteness in the primary and secondary schools, and the feasibility of teaching agriculture in rural schools, giving examples of successful work along this line and reviewing briefly the present status of school work in agriculture.

Report of the committee on industrial education: School gardens (*Pub. Ed. Assoc. Phila., Ann. Rpt., 25 (1906), pp. 32, 33*).—A summary of the school garden work under the control of the Board of Public Education in Philadelphia in 1905.

During the year the number of school garden centers was increased from 2 to 10 and a training class for teachers was conducted. Most of the garden work was done outside of school hours, and it thus gave the children "an adequate substitute for the alluring but demoralizing street life that is their only alternative until they are fourteen years old and able to go to work." The garden work was in some cases closely correlated with the schoolroom work.

Each garden had 250 individual plats averaging 4½ by 12 ft., and a playground open to all children in the neighborhood. Pupils in primary grades visited the gardens with their teachers for nature study lessons and garden products were sent to the schools for study.

Status of veterinary and agricultural instruction, VAN DER BRUGGEN (*Rapport Triennal sur l'Enseignement Vétérinaire et sur l'Enseignement Agricole. Brussels: J. Goemaere, 1906, pp. XXXII + 216*).—This is a triennial report on veterinary and agricultural instruction in Belgium.

The report includes detailed information concerning collegiate, secondary, primary, and itinerant instruction in veterinary science, agriculture, and horticulture throughout the Kingdom; also the educational features of expositions, the publications of the department of agriculture, and the inspection of agricultural institutions. In the appendixes reports on courses of study, attendance, income, and other important matters are given for each institution under the direction of the department.

Agricultural education in Denmark and Sweden, J. SAELAND (*Tidsskr. Norske Landbr., 13 (1906), No. 6, pp. 245–262*).

Twenty-five years of Tuskegee, B. T. WASHINGTON (*World's Work, 11 (1906), No. 6, pp. 7433–7450, figs. 23*).—A review of the work at the Tuskegee Normal and Agricultural Institute since it was started, and an account of the influence of the school upon the negroes of the South, with a list of similar institutions started and conducted by graduates of Tuskegee.

What Hampton means by education, A. SHAW (*Amer. Mo. Rev. of Reviews, 34 (1906), No. 3, pp. 305–314, figs. 17*).—After discussing the educational problem in the South, the writer takes up the kind of education given at Hampton, dwelling especially upon the training of teachers for negro schools and the undergraduate agricultural course.

The army training schools at Fort Riley, C. S. WEST (*World To-Day, 11 (1906), No. 4, pp. 1052–1058, figs. 7*).—This is a description of the training school for bakers and cooks, and of the training school for farriers and horseshoers, established by the War Department in connection with the School of Application for Cavalry and Field Artillery, at Fort Riley, Kans.

The school for bakers and cooks extends over a period of 4 months and includes instruction in the various processes of baking and cooking with a variety of apparatus and utensils, such as would be found in garrison service or in the field.

The school for farriers and horseshoers consists of 2 terms of 4 months each, and is composed of classes of especially recommended enlisted men, who are instructed in the anatomy and physiology of the horse, causes and treatment of

diseases, wounds, etc., as well as the different kinds and uses of horseshoers' tools and the processes of shoeing to meet different conditions and needs.

Teaching the rudiments of cooking in the class room, ESTELLE REEL (*Washington: Govt. Printing Office, 1906, pp. 62*).—Primary methods and outlines prepared as a guide for teachers in the Indian schools, who are urged to give attention to instruction in cooking as one of the features of regular class-room work. The work is included in all years of the Indian school work. Sample lessons are given, as are also outlines of courses in cooking used in Chicago schools, at the Hampton Normal and Agricultural Institute, and in rural schools about Norfolk, Va.

Agricultural practices and morals, E. J. WORTLEY (*Kingston, Jamaica: Educational Supply Co., 1906, pp. 24, figs. 6*).—A manual of practice for use in the public schools of Jamaica.

Agriculture in our public schools, E. J. KYLE (*Gulf Coast Line Mag., 2 (1906), No. 2, pp. 71-78*).—A discussion of the need of teaching agriculture in public schools, suggestions for garden work from September to May, a list of six suitable text-books for use in this connection, and a syllabus for an elementary course in agriculture taken from Circular 60 of this Office.

Concerning nature study and primary agriculture, T. H. SCHEFFER (*Industrialist, 33 (1906), No. 1, pp. 3-9*).—This is an interpretation of the causes of discontent with rural life and an effort to find a partial remedy for this condition through the introduction of nature study and elementary agriculture into the rural schools. The article is suggestive of methods of presenting these subjects and dwells upon the importance of pleasant surroundings for both school and home as an element in creating a love for the country.

Report of the committee on school gardens and native plants for the year 1905, H. S. ADAMS (*Trans. Mass. Hort. Soc., 1906, I, pp. 113-293, pls. 9*).—This is the last report of the Committee on School Gardens and Native Plants, it having been decided to discontinue the work with children's herbariums and native plants and confine the efforts of the committee henceforth to the encouragement of gardening among children both in school and at home.

The report for 1905 deals with children's school gardens, home gardens, herbariums, and exhibits of native plants. Abstracts are given of addresses made at a children's garden conference held in Horticultural Hall, Boston, December 2, 1905. The subjects of these addresses are as follows: School Garden Work in Boston Schools, by Miss Esther F. Hallowell; School Gardens as a Preparation for College, by F. A. Waugh; The School Garden as a Factor in Village Improvement, by Philip Emerson; Children's Gardens from Frost to Frost, by H. D. Hemenway; School Garden Work in Cleveland, Ohio, by Miss Louise Klein Miller; Children's Garden Exhibitions, by A. H. Hixon; School Garden Notes, by F. M. Marsh, and Ten Minutes in a Boy's Garden, by Miss Elizabeth S. Hill.

The report also includes reports on school gardens at Cobbett School, Lynn, Groton, Lincoln, and Sewall schools at Brookline and Fairhaven.

The report closes with a number of accounts of children's home gardens and a list of prizes and gratuities awarded in 1905.

An outline in garden study, BERTHA M. BROWN ET AL. ([*Hyannis, Mass.: Author, 1906, folio*]).—This is a chart prepared by the teachers of the State Normal School, Hyannis, Mass., showing diagrammatically how school garden work may be related to other subjects in the primary school.

School gardens, W. W. LIVINGSTONE (*Agr. Econ., 39 (1906), No. 441, p. 277, fig. 1*).—The writer discusses the value of school gardens as aids in nature study teaching and describes briefly the nature of such work in Staffordshire and Surrey counties, England.

Gardens for city schools, H. G. PARSONS (*Nature-Study Rev., 2 (1906), No. 6, pp. 204–206*).—Suggestions for planting and managing a small garden connected with a school of 1,500 children in the city.

A city school garden (*Md. Agr. Col. Bul., 3 (1906), No. 1, pp. 1–24, figs. 19, dgm. 1*).—This bulletin contains an introduction by R. W. Silvester, which is followed by an account of the school garden work at School No. 33, Baltimore, Md., by Miss Virginia McGaw.

Nature study and high school chemistry, A. SMITH (*Nature-Study Rev., 2 (1906), No. 6, pp. 193–198*).—This is an article dealing with the kind of instruction in nature study that the author would like students to have before taking up chemistry in the high school. He does not favor attempting to teach many facts concerning the elements of chemistry, but would have exercises in all phases of nature study conducted in such a way as "to keep 'the tentacles of inquiry' functional, if not to develop them."

The farmers' institutes in the United States, 1905, J. HAMILTON (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1905, pp. 359–413*).—An account is given of the work of the Farmers' Institute Specialist of this Office, of the meeting of the American Association of Farmers' Institute Workers in 1905, and of the progress of the farmers' institutes in the different States and Territories, including statistical data regarding the number of institutes, the attendance, the number of lecturers employed, and the financial support of the institutes.

The farmer's reading course, S. W. FLETCHER (*Mich. Bd. Agr., Inst. Bul. 12, pp. 70–74*).—Suggestions for conducting reading courses for farmers and for farmers' wives, based largely on the courses conducted by the New York State College of Agriculture at Cornell University.

MISCELLANEOUS.

Annual Report of the Office of Experiment Stations, 1905 (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1905, pp. 413, pls. 11*).—This includes the usual report on the work and expenditures of the Office of Experiment Stations and the agricultural experiment stations in the United States, including Alaska, Hawaii, and Porto Rico; statistics of the agricultural colleges and experiment stations for 1905; a brief account of the nineteenth annual meeting of the Association of American Agricultural Colleges and Experiment Stations; and several articles and reviews abstracted elsewhere in this issue. The report is preceded by a general summary.

Seventeenth Annual Report of Connecticut Storrs Station, 1905 (*Connecticut Storrs Sta. Rpt. 1905, pp. 224*).—This contains the organization list of the station, a list of station publications available for distribution, a financial statement for the fiscal year ended June 30, 1905, reports of the director and heads of departments, and several articles which are abstracted elsewhere in this issue or have already been noted from other sources (E. S. R., 17, pp. 79, 388, 1186).

Thirteenth Annual Report of Minnesota Station, 1905 (*Minnesota Sta. Rpt. 1905, pp. XIII+283*).—The report of the director includes the financial statement for the fiscal year ended June 30, 1905, and summaries of the work of the different divisions and of the northwest and northeast experiment farms. Reprints of Bulletins 87–92 of the station are appended.

Eighteenth Annual Report of Mississippi Station (*Mississippi Sta. Rpt. 1905, pp. 35*).—This contains the organization list, a brief report of the director, a financial statement for the fiscal year ended June 30, 1905, and reports of heads of the departments containing experimental work, abstracted elsewhere. A report of the work at McNeill Substation is also included.

Twelfth Annual Report of Montana Station (*Montana Sta. Rpt. 1905, pp. 230–296*).—This contains the organization list and financial statement for the fiscal year ended June 30, 1905, a report of the director on the general work of the station during the year, lists of station publications, donations, and exchanges, and departmental reports, the experimental work of which is noted elsewhere in this issue.

Sixteenth Annual Report of New Mexico Station, 1905 (*New Mexico Sta. Rpt. 1905, pp. 35*).—This includes a report of the director on the work and publications of the station, a list of station publications available for distribution, departmental reports on the various lines of station work conducted during the year, and a financial statement for the fiscal year ended June 30, 1905.

Experiment Station Work, XXXVI (*U. S. Dept. Agr., Farmers' Bul. 262, pp. 32, figs. 2*).—This number contains articles on the following subjects: Water for table use, phosphates, winter wheat, glutenous and starchy wheats, dry farming, methods of canning, beet molasses and pulp, feed lots, guinea fowls, color of eggs, spraying for scale insects, and white pine in New England.

NOTES.

Alaska Stations.—J. W. Neal, who has been in charge of the Copper Valley Station from its inception in 1902, has resigned to take effect February 1. His successor has not yet been appointed.

At the Rampart Station all varieties of grain grown—that is, winter wheat, winter rye, barley, and oats—are reported to have matured during the past season, as during the 6 years previous, while at Copper Valley, 3½° farther south, grain was again killed by frost occurring about the middle of August. The reason for this anomaly is not apparent. The work of the Alaska Stations indicates that there are considerable variations of climate in different parts of the Territory and that the possibilities of each portion can not be foretold with accuracy until each is tested. The development of early maturing varieties of grain is one of the important problems which the stations are attempting to solve.

Connecticut Storrs College and Station.—J. M. Trueman of the Illinois University and Station has been appointed dairy husbandman in the college and station, and will assume his duties April 1.

Delaware Station.—Margaret B. MacDonald, Ph. D., has recently been appointed assistant chemist.

Florida Station.—The office of the director has been installed at Gainesville, and this will henceforth be the address of the station. John M. Scott, of the New Mexico College and Station, has assumed charge of the work in animal husbandry.

Hawaii Station.—Edmund C. Shorey has resigned his position as chemist.

Indiana Station.—Arrangements have recently been made with one of the railroads of the State to run a seed-corn special over its entire system, beginning February 25. This includes a trip of some 1,500 miles and will require about 15 days. The corn trains already sent out have created very widespread and intense interest among the farmers of the State.

Kansas Station.—A second egg-laying contest has just been inaugurated, to continue for one year. Pens of six hens and a cockerel of each of 24 breeds have been entered. Trap nests are provided so that the contest will be also a test of individuals as well as of the cost of egg production.

Maryland Station.—C. P. Close, horticulturist at the Delaware Station, has succeeded W. N. Hutt as horticulturist, the latter having resigned to accept a similar position with the North Carolina department of agriculture and experiment station, as previously noted.

Missouri University and Station.—The State board of agriculture has recommended an appropriation of $226,000 for the college of agriculture, $200,000 to be used for an agricultural building. B. R. Thompson, a graduate of the Kansas College, has been appointed assistant in dairying in the college, and R. C. Donaghue, of the University of Ohio, assistant in agronomy in the station.

Nebraska Station.—A decision of the supreme court of the State affecting the

Adams fund is of interest to stations whose funds are deposited with the State treasurer. The State auditor of Nebraska declined to pay out the Adams fund from the State treasury on the requisition of the board of regents, on the ground that the legislature had not specifically appropriated the fund. The supreme court in a decision rendered November 10, 1906, held that "the fund never belonged to the State," but "was paid to the State treasurer as the agent of the board of regents and custodian of the funds of the university," and that in view of the nature of the fund, and a previous act of the legislature relating to the funds of the station derived from the Hatch Act, or supplemental acts, "it seems clear that in general terms the expenditure of said fund by the board of regents is clearly authorized, and no other or more specific appropriation is necessary." (Decision in *Northwest Reporter*, Dec. 18, 1906, p. 770.)

Recent appointments to the station staff include A. F. Magdanz, assistant in animal husbandry; L. B. Sturdevant, assistant in animal pathology; and F. E. Denny, assistant in horticulture.

Nevada Station.—The resignation of N. E. Wilson, consulting chemist, is announced. Dr. W. B. Mack, of Cornell University, has accepted the position of veterinarian and bacteriologist, and assumed his duties January 1.

New Hampshire College and Station.—The resignation of Ivan C. Weld, in charge of dairy manufactures, is reported.

Cornell University and Station.—*Cornell Countryman* states that S. M. Herrick, assistant in agricultural chemistry, has become assistant chemist at the Virginia Station.

Ohio University.—A recent communication from the president of the Percheron Horse Society of France announces that the society has voted to offer to the department of animal husbandry of the university an object of art representing a Percheron horse. This trophy will probably be a bronze figure of a Percheron, and is to be competed for annually by the students taking instruction in horse judging at the university, the one showing the greatest proficiency having his name inscribed on the base of the trophy. This action of the society is the outgrowth of a visit to this country in 1904 of Mr. Charles Aveline, its president, who became interested in the educational work of the university upon the horse.

Oklahoma Station.—Work has been begun on a small horse barn to provide for new work under the Adams Act in connection with a study of some of the problems of breeding animals. This work will include a study of the use of the artificial impregnator, and of the effect of various kinds of feed on the breeding powers of animals.

Porto Rico Station.—H. C. Henricksen has resigned as horticulturist to enter the service of the German Kali Syndicate, and is succeeded by Martin J. Iorns, a recent postgraduate student at Cornell University.

Rhode Island Station.—H. L. Barnes has resigned as assistant horticulturist. F. R. Pember, for some years in the employ of the Bureau of Soils, has accepted a position at this station in connection with the soil investigations.

Utah College and Station.—W. M. Jardine, agronomist in the college and station, has resigned to accept a position as assistant cerealist in the Bureau of Plant Industry. Willard C. Snow, assistant chemist, resigned November 1 to engage in private work.

A new publication entitled *Rocky Mountain Farming* has been started by the faculty. It is aimed to make it a general farm paper for the Rocky Mountain intermountain region, to serve also as the organ for college extension work. The contributors are principally members of the station staff and the faculty, and students of the institution.

Vermont Station.—The State legislature has, by a joint resolution, assented to the purposes of the Adams Act, and designated the station as beneficiary, and has appropriated $500 annually for the next 5 years for the establishment and maintenance of a nursery for the distribution of forest seedlings. The latter will be located upon a farm owned by the university.

International Live Stock Exposition.—The seventh exposition of the International Live Stock Association, held in Chicago during the week of December 3, proved even more successful than those of previous years. The number of entries was 30 per cent greater than ever before, the increase being especially noticeable in sheep. The quality of the stock exhibited also showed improvement in most classes. In spite of the doubling of the price of admission and of an additional charge for reserved seats, popular interest seemed unabated, and the attendance broke all records, thousands being turned away each day. Plans to enlarge the amphitheater by one-third are now under contemplation.

At a meeting of the directors of the association a new plan of organization was decided upon. A new board was elected, consisting of 24 members, chosen for terms ranging from 1 to 3 years, so that in future only one-third will be elected each year. Prof. C. F. Curtiss, of Iowa, a former director, was among those elected for 2 years.

The influence of the agricultural colleges and stations was again strongly in evidence throughout the exposition. A considerable portion of the judges were taken from their ranks, and their exhibits attracted widespread interest. Previous to the exposition a petition had been sent in by exhibitors to debar the colleges and stations from the open competitions, but this was not granted, and in nearly all classes a large proportion of the prizes fell to their share.

In the fat-stock division their predominance was especially marked. In the display of fat barrows Ohio State University furnished the champion Berkshire, and Iowa State College the champion pen of 3. In Poland Chinas and Duroc Jerseys all championships went to Iowa. North Dakota took a second on a pen of large Yorkshires, and Wisconsin a first and second and the championship for the Tamworths. The grand championship for a pen of 3 barrows, all breeds, was awarded to Iowa. In dressed hogs Wisconsin was first for carcasses of 300 lbs. and over. Iowa took second in this class and first for carcasses from 200 to 300 lbs. in weight.

For fat wethers Wisconsin took two seconds and a third for Shropshires, second on a pen of 5 lambs of Southdowns, and third for yearling Hampshires, and in Cheviots first for yearlings, second and third for lambs, first for a pen of 5, and the breed championship, besides 11 prizes for grades and crossbreeds. Iowa was awarded first for yearling Oxfords. For dressed sheep Iowa took second and third for wethers, and Wisconsin first for lambs and the champion carcass of the show.

In fat cattle, Kansas took a first and 2 fourths for Shorthorns, besides a second on herd. Nebraska received a second, Purdue a second and third, and Ohio a first. Iowa and Minnesota won first in the Hereford class, and Purdue a fifth. For the Aberdeen Angus, Minnesota carried off first for 2-year-olds and yearlings, and the breed championship for single steers and herds. Kansas took first in Angus calves, and Nebraska a fourth. Ohio won first for 2-year-olds and the breed championship with Galloways, Minnesota receiving a third. In the 2-year-old class for grades and crosses, Kansas won first, North Dakota second, and Iowa fifth.

For senior yearlings Ohio was second and Minnesota third, and for junior yearlings Iowa took first and fourth, Purdue and Kansas capturing second and third. Nebraska was first in the class for junior calves, Iowa third, and Purdue fourth. Iowa won first and fifth for herds, and the champion herd of the

show for all breeds was from Minnesota. For the first time in the history of the show, grand championship honors went to a calf, Peerless Wilton 39th's Defender, a Hereford, since sold to the Iowa College. The second choice was an Angus yearling, Andy, owned by the Minnesota Station.

In the breeding stock section the entries from the colleges were less numerous. Purdue secured a third on aged Shorthorn bulls, and Wisconsin and North Dakota carried off several special prizes for American Rambouillets. In response to a general demand from swine breeders, arrangements were made whereby the classes for breeding swine, which were discontinued 2 years ago because of the danger of transmission of infectious diseases, are to be restored under certain restrictions.

The special classes for college and station stock were again continued, and resulted in an even larger number of entries and sharper competition than ever. In the class for 2-year-old cattle Nebraska was first, Minnesota third, and Kansas second and fourth. For yearlings Minnesota took first, second, and fourth, and Nebraska third. Kansas took first and third for calves, Minnesota second, and Nebraska fourth. For a pen of 5 steers the first place went to Minnesota. Nebraska furnished the champion of the college steers, Ruby Zenoleum. Wisconsin was awarded all prizes for sheep. For swine Iowa received first for a barrow under 12 months, Ohio second, and Wisconsin third. For a pen of 5 Iowa was first, followed by Wisconsin and Ohio, and the champion barrow was from Iowa.

As in previous years, the students from the colleges were most liberally represented. Iowa, Illinois, and Minnesota sent over 100 each, and smaller delegations came from Virginia, Wisconsin, Indiana, Ohio, Michigan, Missouri, Texas, Colorado, Nebraska, North Dakota, Kansas, and Ontario. During the exposition the American Federation of Agricultural Students held an enthusiastic meeting.

The students' stock-judging contest was participated in by 6 institutions. Ontario Agricultural College led in the work with cattle and sheep, and once more scored the highest total of points, followed by Iowa, Ohio, Kansas, Michigan, and Texas. Iowa won back from Ohio the horse-judging trophy, and Kansas made the best record with swine. The corn-judging team from Iowa succeeded in maintaining its hold on the Cook bronze trophy, Kansas receiving second, and Missouri third.

A new form of intercollegiate competition was inaugurated by the *Chicago Daily Live Stock World*, which offered $300 in 20 cash prizes for reports by students of the various sections of the exposition. The best showing was made by the Iowa men, who won first and second for cattle, first and fourth for swine, first, second, and third for horses, and fourth for sheep.

One of the most noteworthy features of the exposition was its international aspect. King Edward and Lord Rothschild were among the competitors in the horse-breeding section. Sheep were entered from England, and Canada sent cattle, horses, sheep, and swine. In the crowd of spectators were visitors from England, Scotland, and the Argentine Republic, and the agricultural departments of Nova Scotia, Quebec, Ontario, and Hawaii were officially represented. The announcement was made by the German consul that after careful investigation he had advised his government to enter exhibits in the future.

Progress on New Department Building.—The report of the building committee on the new laboratories for this Department states that the work has progressed, with the exception of the interior finish, to approximately the fourth-floor line, and it is expected that without unforeseen complications the buildings will be completed within the contract time, November 14, 1907. Within the $3\frac{1}{2}$ years that have elapsed since the act authorizing the construction of the new quarters was approved, there has been an increase in the rented space occupied

by the Department of over 99 per cent, and an increase in the annual rentals of 150 per cent.

Measures before Congress.—A bill has been introduced into Congress by Senator Nelson and Representative Davis to increase the annual appropriation to agricultural colleges. The bill provides an increase of $5,000 to each college for the year ending June 30, 1908, increasing this amount $5,000 each year for 5 years, when a maximum annual appropriation of $25,000, in addition to the Morrill Fund, will be reached. A portion of the appropriation may be used "for providing courses for the special preparation of instructors for teaching the elements of agriculture and the mechanic arts."

Other bills recently introduced into Congress include the following: A joint resolution to provide for the printing of 50,000 copies each of the Special Report on the Diseases of the Horse, and of the Special Report on the Diseases of Cattle; to appropriate $50,000 additional for demonstration farms in the cotton boll-weevil district; appropriating $250,000 to eradicate the Texas fever tick; for the establishment of a drainage fund and the construction of works for the reclamation of swamp and overflowed lands, and for the maintenance of agricultural colleges in Congressional districts. The urgent deficiency bill as passed contains an appropriation of $250,000 to enable the Secretary of Agriculture to enforce the provisions of the pure-food law enacted at the last session.

Conference on Secondary Education in the South.—At a conference recently held at the University of Virginia, participated in by representatives from Southern State universities and colleges, superintendents of education, and other invited educators, a session of 4 hours was given to the discussion of agriculture in high schools, at which addresses were given by Dr. S. A. Knapp, of Louisiana; D. J. Crosby, of this Office; Prof. William Lochhead, of Macdonald College, and others. It seemed to be the consensus of opinion that all over the South there is an increasing demand for instruction in agriculture in schools of different grades, but that it is not now feasible to introduce it into all schools on account of the lack of competent teachers. It was agreed, however, that every effort should be made to take advantage of conditions which seem favorable for its introduction.

Virginia Educational Conference.—At a conference of superintendents, school officials, the State Teachers' Association, and the Virginia Library Association, held at Richmond, A. C. True read a paper on Agriculture in the Public Schools; A. M. Soule, of the Virginia Station, presented a report on The Virginia Farmer and the Schools, and D. J. Crosby gave an illustrated lecture on How Agriculture is Taught in the Public Schools.

New Veterinary College and Physiological Laboratory.—*The Breeders' Gazette* states that substantial progress has been made toward establishing a veterinary college at the Chicago Union Stock Yards as a department of the University of Illinois. A proposition to this effect has been submitted to the trustees of the university and has met with favorable consideration. The object of this institution will be, in addition to the training of ordinary veterinary practitioners, the supplying of inspectors for the Government service. In connection with the veterinary instruction the project contemplates completely equipped laboratory for physiological research. It is understood that the packing houses propose to contribute liberally toward the erection of buildings and the initial endowment, but that the management will rest entirely with the University of Illinois.

Downton College Closed.—The College of Agriculture at Downton, England, according to a recent note in *Mark Lane Express*, has been closed. This college was a private institution, opened in 1880 by Professor Wrightson, and was quite

successful until the outbreak of the Boer War in 1899, when, owing to the enlistment of many of the students, the enrollment was reduced to about 17. Since the close of the war the number of students has increased, but not sufficiently to warrant keeping up the school.

Domestic Training College in Scotland.—The opening of what is said to be the first Scottish domestic training college at Dunfermline is noted in the *Epicure* for November. Bonnyton House, Dunfermline, has been leased for the purpose. The instruction will include both outdoor and indoor work. The outdoor training is to embrace gardening, beekeeping, dairy work, and poultry rearing, while that indoors will include cookery, laundering, house and table work, dressmaking, and household management.

Agriculture Introduced at the Technical High School at Prague.—A recent number of the *Deutsche Landwirtschaftliche Presse* states that an agricultural department, offering a four-year course, has been established at the Royal Imperial Bohemian Technical High School at Prague. Prof. Julius Stoklasa has been elected dean of the department of agriculture, as well as of the department of "culture-technic." The studies to be taken up this year are higher mathematics, physics and mechanics, organic and inorganic chemistry, anatomy and physiology of plants, economic botany, general and economic zoology, mineralogy and geology, agricultural bacteriology, general biology, and rural economics, including practicums in the chemical and plant laboratories.

Agricultural Work at Birmingham University.—A department of economic zoology has been organized under the direction of W. E. Collinge. *Mark Lane Express* states that this is to be a "consultative department and bureau of information and experimental work," and that it is the first instance in which a university in Great Britain has offered farmers an opportunity for such free information.

Agriculture in Great Britain.—A report of a special agricultural committee, appointed by the tariff commission to examine the probable effect of a high-tariff system on agriculture, shows some striking changes in agricultural conditions in Great Britain. The wheat production, which in 1841–1845 was reported as sufficient for 90 per cent of the population, now supplies only 10.6 per cent. The area cultivated to grain crops has decreased 40 per cent in thirty years. Home-fed meats, representing 85 per cent of the total supply thirty years ago, now furnish but 55 per cent. On the other hand, dairy produce shows an increase of 140 per cent, and now forms the chief branch of agriculture in England. "Agriculture in almost every branch shows a great decline, despite a very large increase in the population and a consequent increase in the demands for agricultural produce." This condition of affairs is attributed to a greater relative increase in local and imperial taxation on land, transport conditions, and the inability of the board of agriculture to aid the British farmer as his foreign competitors are aided.

Irrigation in New South Wales.—The *Scottish Geographical Magazine* reports some particulars of a great irrigation scheme which the New South Wales government proposes to carry out in the Murrumbidgee Valley and the Lachlan, Namoi, and Gwydor basins. The first step which it is proposed to undertake is the construction of a dam across the Murrumbidgee, thereby forming a reservoir to contain 1½ times as much water as Sydney Harbor, and but little inferior to the great Nile dam. The full capacity of the reservoir will be 33,380,864,000 cu. ft., and the cost is estimated at about four million dollars. The catchwater area is 5,000 square miles. The water will be brought to the land to be irrigated entirely by gravitation, so that pumping will be unnecessary.

Miscellaneous.—The board of agricultural studies at Cambridge University has appointed Major P. G. Craigie, whose resignation as secretary of the British

Board of Agriculture and Fisheries was recently announced, to be Gilbey lecturer on the history of economics in agriculture.

The *Deutsche Landwirtschaftliche Presse* reports the death of Prof. Albrecht Konrad Thaer, of Giessen, on November 14, 1906. He was born in 1828 at Lüdersdorf, in the province of Brandenburg, and was a nephew of the renowned "father of rational agriculture." In 1860 he was appointed professor of agriculture at the University of Berlin. From 1871 until his retirement in 1901 he was director of the agricultural institute, laboratory and experiment field at Giessen.

W. R. Buttenshaw, a scientific assistant in the imperial department of agriculture for the British West Indies, has accepted an appointment as botanist in the agricultural department of India.

A recent number of the *Deutsche Landwirtschaftliche Presse* states that von Arnim-Criewen will succeed von Podbielski as State minister and minister of agriculture, domains, and forestry of Prussia.

A. C. Seward, well known for his research into the structure and affinities of fossil plants, has been appointed to fill the vacancy in the professorship of botany at Cambridge, occasioned by the death of Marshall Ward.

A recent issue of *Science* states that Dr. M. T. Cook has resigned his position as chief of the department of plant pathology of the Central Agricultural Experiment Station of Cuba, and expects to devote several months to studies at the New York Botanical Garden.

The Harvard Graduate School of Applied Science, which was established last spring, announces degree courses in landscape architecture and forestry. A bachelor's degree is required for admission to this school, and provision will be made for original work.

Armstrong College is the recipient of a legacy which will eventually amount to $225,000. A portion of this fund must be used for increased compensation of the instructor in agriculture.

The agricultural school at Cawnpore is now in process of development into a college, and will henceforth have a three-year course, instead of a two-year course, as formerly. A number of residences for members of the faculty have recently been erected, and plans for the extension of other buildings are under consideration.

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EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, Ph. D., *Assistant Director.*

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LIST OF EXPERIMENT STATION AND DEPARTMENT PUBLICATIONS REVIEWED.

NOTE.—The publications of the United States Department of Agriculture, except those of the Weather Bureau, may be purchased from the Superintendent of Documents, Washington, D. C. For the publications of the Weather Bureau requests and remittances should be directed to the Chief of the Bureau. The price of the Record is $1 per volume, or 10 cents per number. The prices of other technical publications are given in the list above. The publications of the State experiment stations are distributed from the stations and not from the Department.

EXPERIMENT STATION RECORD.

Vol. XVIII. February, 1907. No. 6.

The need of a systematic study of the science of education was the main subject discussed in the address of Dr. C. M. Woodward as retiring president of the Association for the Advancement of Science, at its New York meeting. Doctor Woodward called attention to the fact that "the history of education is full of the records of whims and fancies, of experiments real and imaginary, conducted in order to prove the worthlessness of some theories and the worthiness of others. Every parent has a dimly defined theory of how his boy ought to be educated, and every teacher looking back over his own experience as a pupil formulates more or less clearly a 'system' for the proper education of his pupils. It goes without saying that such theories and so-called systems are generally shallow and inadequate;" but they nevertheless have their influence under our present conditions, and contribute to the confusion.

The speaker expressed his belief in a science of education, as a safe guide to the proper development and adjustment of our educational systems. "I do not claim to have formulated the science of education," he said, "and I know of no one living who has ventured to make such a claim; and yet I believe that a science of education is possible—and it is high time that we set about a systematic study of its essential features, with a view to a formal statement of its main principles."

He called attention to some of the fundamental principles which need to be worked out on a scientific basis—"Educational values are to be determined, taking into consideration age, sex, environment, taste, brain development, and probable sphere of usefulness." And he proposed the organization of a new section of the American Association, to be devoted to the advancement of the science of education, pointing out a wide range of questions for consideration by such a scientific body.

President Woodward's suggestions are especially timely in view of the changes both in subjects and in methods which are now taking place in school curricula, changes so marked that the term "new education" is not infrequently applied. The "new" in education has

come about largely through the introduction of so-called industrial subjects and the laboratory method of teaching. If it be true that there is confusion or lack of knowledge regarding the fundamental principles of education, which have engaged the earnest consideration of philosophers and sages for centuries, what of agreement can be expected concerning the essentials of subject-matter or method in teaching these newer subjects which have come into our schools within a few decades?

Take, for example, one of these industrial subjects, agriculture. It is only within comparatively recent times that the sciences upon which agriculture rests have been taught with any reference to their relation to the production of crops and animals, only within three or four decades that agriculture has been taught as a separate subject, and only within quite recent years that a science of agriculture comparable to the science of medicine has been recognized. Educators are not yet agreed upon the scope of this ancient art and modern science. They have not come to full accord as to the definition of agriculture. There are those who would confine it to plant production or agronomy, not including horticulture or forestry, while others would have it include in a general way not only all phases of plant production, but animal production, agrotechny, and such phases of economics, mechanics, and engineering as have a bearing upon the planning and management of farms, the construction and care of farm structures and machinery, the keeping of farm acounts and records, and the marketing of produce.

The relation of the instruction in the basal natural sciences to that in agriculture has also given rise to many pedagogical questions. Many educators insist that a thorough grounding in physics, chemistry, botany, and zoology is a prerequisite to a proper comprehension of the science and practice of agriculture, and should therefore precede any attempt to teach agriculture in schools. Others would so interweave instruction in the primary sciences and agriculture as to do away with separate courses in the former for students of agriculture.

In the very elementary agricultural instruction the children are taught facts concerning plants, animals, chemical elements, the laws of physics, etc., whenever a knowledge of these things seems to be necessary. In other words, the instruction proceeds through the concrete to the abstract, a plan which is quite generally advocated for elementary instruction, and which seems to meet with good success. Should this plan be carried on up through the high school and the agricultural college, thus doing away with all separate work in physics, chemistry, botany, and zoology? If not, at what point should the order of procedure be modified or reversed? It would

seem that fundamental research in agricultural education would shed light upon such problems as these. There are many others, among which may be mentioned the relative importance of the text-book, the lecture, the seminar, and the practicum in teaching agriculture, the rational basis for the development of the practicum, the educational value of agriculture and of the agricultural practicum, etc.

The problem which seems to be of the most vital present concern to the whole movement for promoting better agricultural conditions is that of training teachers for all grades of schools. The efforts which some of the colleges of agriculture are making along this line indicate that they appreciate the importance of such training and their duty in the matter, but as yet few of these institutions have undertaken serious work in the preparation of teachers of agriculture.

Eleven State universities with which colleges of agriculture are connected and one separate college of agriculture have departments of education, but only four of these have anything in their catalogues to indicate that agricultural subjects are in any way considered in the study of education. Six of the agricultural colleges (including two of those referred to above) offer regular normal courses, and one (Massachusetts) has a State appropriation to enable it to develop such courses. Two of these normal courses are innocent of agricultural subjects and another contains no pedagogy or other professional training in education. There are seven colleges of agriculture offering short normal courses of one to three years, thirteen that maintain summer schools for teachers, and five, not included in any of the above lists, that give one or two courses each in pedagogy, psychology, and history of education.

There are therefore thirty-two of the land-grant institutions for whites which offer courses intended for teachers; seven of these confine this work to short summer schools or to one or two units of pedagogy or psychology, leaving twenty-five that are making a serious effort to solve the teacher problem. Fourteen out of these twenty-five colleges mention agriculture in their courses for teachers. This is a modest showing, but it is encouraging in comparison with conditions a few years ago when scarcely a land-grant college in the country held out any inducement to teachers.

In some of these institutions the normal work is organized on a very broad and substantial basis. The University of Missouri, for example, has a teachers' college in charge of a professor of educational psychology. It offers undergraduate work leading to the B. S. degree and a life certificate for teachers, and graduate work leading to the A. M. and Ph. D. degrees. The studies include professional subjects in education such as the philosophy of education, pedagogy, school

supervision, etc., and also agriculture, horticulture, manual training, and other special or technical subjects taught by the professors and instructors in the college of agriculture.

In the University of Illinois there is a department of education with ten courses, and this year there has been added a special instructor to teach agriculture to prospective teachers. The University of Arkansas offers a four-year normal course in which agriculture and horticulture are taught. The Kansas College prepares teachers for three-year certificates, which are renewable for life. The Mississippi College has a department of industrial pedagogy and offers a four-year course in industrial pedagogy, which includes agricultural subjects. The State College of Washington offers fifteen courses in education, including one course in methods of teaching agriculture. The Massachusetts Agricultural College has a State appropriation of $5,000 for the support of normal instruction and is planning to organize this work largely along agricultural lines.

The training of teachers of agriculture is just now a matter of great importance. Owing to the rapid development of the agricultural colleges, the establishment of many new agricultural high schools, and the introduction of agriculture into public secondary and elementary school curricula, the demand for capable teachers of agriculture is far greater than the supply. The normal schools in the different States have shown a commendable desire to meet this emergency, and some of them, notably in Missouri, Nebraska, Oklahoma, and Wisconsin, have succeeded in developing fairly strong secondary courses. But most of the normal schools have been compelled to content themselves with the more elementary work known as nature study and school gardening, such as would give preparation for the kind of work now generally done in city public schools.

A careful survey of the whole field reveals the fact that there is as yet no adequate provision for the preparation of teachers to take charge of agricultural courses in schools of agriculture, normal schools, or other secondary schools, nor is there any definite attention or encouragement given to the professional training of instructors for the agricultural work in agricultural colleges. The normal schools as at present organized can not do this higher work, nor can it be done by the great universities unless they maintain colleges of agriculture.

The duty of training teachers of agriculture for both colleges and secondary schools will, therefore, under present conditions, fall upon the agricultural colleges, and the needs of the time are so great as to make this duty almost imperative. Some of the larger agricultural colleges, especially those which are departments of universities, might well provide facilities and encouragement for fundamental research

in the science of education in its relation to agricultural subjects, and all should make provision for training teachers of agriculture.

By this it is not meant that the agricultrural colleges should invade the field of the normal schools. They should merely do the work that the normal schools are not yet in position to do, nor can ever be in a position to do fully. The normal courses offered by the agricultural colleges should be no less thorough in their agricultural features than the courses now crowned with the bachelor's degree. On the other hand, it should not be thought sufficient for the agricultural colleges to offer one or two term electives in psychology or pedagogy or history of education, and say that the students who complete these subjects in connection with the regular four-year course are prepared to teach agriculture. The course for teachers should include the essential features of both an agricultural and a normal course, and these should be so brought together and combined as to make a well-balanced course, sound pedagogically, and affording training for the mind and training for the profession of teaching.

It may be said that such courses might now be arranged by election from the subjects offered in departments of education and in the colleges of agriculture of some of our universities. True, but not more than three universities in the country have thought this matter to be of sufficient importance to warrant mention of it in their catalogues.

Nearly every young person when planning his college course takes up old, well-established groups of studies or follows outlines suggested in the college catalogue. Hence the mere announcement in the catalogue of courses for the training of teachers of agriculture would tend to increase the number of students in these courses, by directing attention to them; and the colleges of agriculture where the necessary electives for a good normal course are now offered might well give some attention to arranging and announcing groups of studies adapted especially to the training of teachers of agriculture.

The colleges not now in a position to offer normal courses could easily prepare for this work by each employing at least one teacher of education and putting him in charge of the planning and arrangement of the normal course. He or his assistants would teach all professional subjects in education, and the other instructors in the college would attend to the other college subjects as they are now doing.

The Carnegie Institution of Washington has for several years been interested in the study of problems in human nutrition, which it has aided with grants. One of its first undertakings in that line was in connection with the investigation carried on by Prof. W. O.

Atwater, at Middletown, Conn., in cooperation with this Department, the work being continued under his successor, Dr. F. G. Benedict. This joint effort has been directed to increasing the efficiency and precision of the respiration calorimeter, previously developed with the aid of this Department, and especially to providing the oxygen annex, making it a closed-circuit apparatus.

So great has been the interest of the Institution in this work and its belief in the possibilities open to it, that it has decided to establish it as one of its permanent lines of research and to provide a special laboratory for it, as has already been done for a few other lines. The nutrition laboratory will probably be located in New York, in connection with one of the large hospitals, and will be devoted particularly to inquiries in relation to medicine, physiology, and hygiene. The fitting up of the apparatus and laboratory will be in charge of Dr. Benedict, who will direct the subsequent investigation.

There are many problems concerned with nutrition in disease and convalescence, and with the energy output and hence the food requirements of the body under various pathological conditions, as well as many questions of ventilation and other branches of hygiene, to the study of which the respiration calorimeter is especially adapted. Such questions have a wide interest and are of far-reaching importance, and as the Department's researches have developed there have been urgent requests that they be taken up. They are, however, distinctly separate from the investigations of the nutritive value of agricultural food products, to which the Department's efforts have been directed, and have seemed rather to belong to some other agency than one working primarily in the interests of agriculture and looking to annual appropriations for continuation.

It is especially gratifying, therefore, to all interested in the subject of nutrition in its broadest aspects, that the Carnegie Institution should have recognized its importance and decided to provide for it as one of its special departments of research. It is thus given greater permanency and greater freedom in scope than could be the case under legislative appropriation, and the possibilities are opened for extending the investigation into theoretical lines where it is much needed.

Especially is this departure gratifying to those who have been interested in the nutrition investigations under the Department, for it is a direct outgrowth of the latter's work which has led up to and made it possible. The development of the respiration calorimeter under the Department's cooperation, and the fundamental inquiries which have been conducted with it for several years past, have stimulated research in this field; and as the apparatus has remained the

only one of its kind in the country it has been looked to as the means of putting to exact test the deductions and conclusions from other investigation.

The wide interest awakened in nutrition studies, and the experimental methods which have been elaborated, are substantial products of the Department's work and influence in this line, and the step taken by one of the highest research institutions of the country is an indication of the way in which the Department's work may prepare the way for and stimulate research in the broader fields of science.

While plans for the continuation of these studies are not fully matured, it is expected that the respiration calorimeter at Middletown will be moved to Washington and installed in the new laboratories now building on the Department grounds.

PROBLEMS OF ANIMAL NUTRITION.[a]

HENRY PRENTISS ARMSBY, LL. D.,
Director Pennsylvania Experiment Station.

Farm animals are kept substantially for two purposes—for the production of work and for the production of human food.

As regards work production, while it is true that horses and other work animals are being replaced to a greater or less extent by other prime motors, such as steam, gasoline and alcohol engines, and the electric motor, such replacement has not yet become possible on the small farm or for anything like all the purposes for which work animals are kept. The production of work is still, and is likely to continue to be, an important branch of animal husbandry.

The twelfth census gives the number of horses and mules over two years old in the United States as, in round numbers, eighteen and one-fourth million, worth one thousand million dollars. Estimating that these animals work on the average only four hours per day and generate three-fourths of a nominal horsepower each, we have the equivalent of the continuous production, night and day, of over two and one-fourth million horsepower, which is nearly one-third the total estimated horsepower of Niagara Falls and many times what is actually utilized.

Notwithstanding the importance of the animal as a prime motor, however, it is as a source of human food that he finds his principal place in American agriculture.

It is estimated by competent authority that over forty-five per cent of the food consumption of the better classes in the United States consists of animal and dairy products. Taking into account the relatively higher prices of these materials it seems safe to estimate that considerably more than half of the expenditure of the average family for food goes for this class of materials. Moreover, whatever, in the light of recent discussion, may be our attitude toward vegetarianism, or our judgment as to the necessary proteid supply, it is certainly a fact, however we may explain it, that those peoples are, as a whole, most efficient which consume a reasonable proportion of animal food.

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[a] Read before the section on experiment station work at the Baton Rouge convention of the Association of American Agricultural Colleges and Experiment Stations, November, 1906.

There were killed in the wholesale slaughtering and packing houses of the United States in 1900 five and one-half million cattle, nine million sheep, and thirty and one-half million swine, or a total of forty-five million animals, estimated to be worth $683,000,000. The value of animals slaughtered on farms was estimated at $190,000,000, making a total value of $873,000,000. Adding to this the value of our dairy products, about $433,000,000, and that of the poultry and egg production, about $282,000,000, we have a total of about $1,588,000,000 for the yearly value of the output of animal foods.

For both of the purposes just named, the animal utilizes the energy originally derived from solar radiation and stored up in vegetable products by the synthetic action of the chlorophyll. The point of economic importance in this connection is that these enormous aggregates represent to a considerable extent a utilization of the potential energy of inedible products which would otherwise be a waste so far as food value is concerned and largely so as a source of power. This is true on the one hand of the leaves, stems, husks, pods, etc., of our various farm crops—the so-called coarse fodders—and on the other, of those manufacturing by-products which accumulate in the preparation of grains and other raw materials for human consumption. By feeding these products to our domestic animals, we utilize for feeding man or performing his work a portion of their stored-up energy, which would otherwise be practically an entire waste. Of course surplus edible products are also utilized in stock feeding and in this country very largely so. This, however, can only be regarded as a temporary phase of our agriculture. While, on the fertile soil of the corn belt, it is often found more profitable to convert corn into beef or pork than to market it directly, as the density of population and the demand for breadstuffs increase, the stock feeder will be more and more constrained to the use of the cheaper by-product feeds in place of grain. From the economic point of view, then, it is highly important that that portion of our national wealth represented by these inedible products should be utilized to the best advantage, yielding a greater aggregate profit to the producer and a more liberal supply of animal food to the consumer.

Time prevents more than a mere reference to the important relations which subsist between animal husbandry and the preservation of soil fertility. While we no longer regard the farm animal as a mere manure machine, still the maintenance of the fertility of the farm is an important element in determining the profits of stock raising, and from this point of view, as well as from that of the more complete utilization of solar energy, those forms of agriculture are to be preferred, other things being equal, which maintain a due balance between the production of crops and of animals.

From all points of view, then, animal husbandry is a most important factor in our agriculture. Into the many exceedingly interesting and important questions regarding the breeding of farm animals I shall not enter at this time, both from lack of time and lack of qualification. The other half of the subject, that of the economic feeding of these animals, however, is certainly of at least equal importance with that of their breeding.

The experiment stations of the United States have not failed to recognize the importance of this branch of agriculture. The station literature of the last twenty years presents an imposing array of bulletins and articles treating of all phases of stock feeding. From a cursory survey we should be led to suppose that our knowledge of the subject was making rapid advances. A closer examination, however, will cause some modification of this first impression. In a paper read before the Graduate Summer School of Agriculture last July, Director Jordan presented a classified list of the subjects of the bulletins upon stock feeding issued by the stations for the years 1903, 1904, and 1905, which shows some rather startling facts. Out of a total of eighty-four bulletins, forty-three were reports upon comparative tests of either single feeds or individual rations. This form of feeding experiment has been almost as great a favorite as its analogue, the variety test, and the results have scarcely been more profitable in the one case than in the other. A reasonably diligent compiler could readily accumulate a great volume of data derived from such comparisons, but I think it very doubtful whether the results reached would be worth the labor. I venture to question whether stock feeders in general have derived very much real permanent profit from this class of experimental work.

Next most numerous on Jordan's list are the experiments, seven in number, upon the adaptability of certain feeds to special animals or purposes, a work most useful with new feeds, and yet a work demanding scarcely more appliances or attention than could be given it by a good practical feeder. Following these come, in equal numbers, experiments upon the substitution of home-grown for commercial feeds, and determinations of digestibility—both classes represented by five bulletins. The class first named—substitution experiments—are of undoubted economic value, but are necessarily of more or less local applicability. As regards digestion experiments, I shall have occasion to speak later.

Not to prolong this enumeration, I think it is not doing injustice to the American stations, whether we judge by the record of these three years or by our general knowledge of their work, to say that while their investigations have brought to light or demonstrated to the farmer many useful facts, local or otherwise, they have served only to a very subordinate degree to reveal principles. The latter

we have seemed largely content to borrow from foreign investigators. To say this is not to deny the great value of much of the work done by our stations, nor to decry the publication of useful information. Nevertheless, the experiment stations stand before the country as the representatives of agricultural science, manned or presumed to be manned by scientific men. As scientific men we should know and should proclaim that permanent progress in agriculture is possible only through the establishment of principles. One principle well founded is worth a thousand facts, because it includes them all. I can not avoid suspecting that the principles which have been borrowed from foreign investigators and popularized by station literature and in other ways have done quite as much to help the practical feeder as our own experiments.

But how do matters stand with our borrowed science of feeding? Will it stand the strain we are putting on it?

The methods of comparing the values of feeds and rations which still largely prevail date back almost fifty years to the fundamental investigations of Henneberg and Stohmann at the Weende Experiment Station, in Saxony, begun in 1858 and published in 1860 and subsequent years. Our methods for the analysis of feeding stuffs, the technic of digestion experiments, and the interpretation of their results, are all, in the main, what were formulated by these investigators. They grouped the digestible organic matters of feeding stuffs into protein, fat, and carbohydrates, the latter including the digestible portion of the "crude fiber" and of the "nitrogen-free extract," and the values of feeds were estimated on the basis of the amounts of these nutrients which they could supply.

Henneberg and Stohmann, however, were fully aware of the fact that such investigation into the content of feeding stuffs constituted but one-half of the problem and that it was just as necessary to determine with equal exactness the real nutritive effect produced by their use. In 1870, in an introduction to a third report upon their work, Henneberg discussed very fully the methods by which this nutritive effect could be determined, with the aid of the respiration apparatus, on the basis of his familiar conception of the schematic body. Not only this, but he formulated a program of systematic investigations and made a beginning in its execution.

The determination of the digestibility of the nutrients in feeding stuffs, however, could be much more easily and cheaply accomplished than the actual determination of their nutritive value according to Henneberg's program. The assumption of the equal value of protein, carbohydrates, and fat from different sources having been once made, it was perhaps not surprising that the average experimenter should accept this assumption and follow the easier path. Almost innumerable digestion experiments have been made during the last forty-five

years, on the basis of which tables have been prepared which give us a very good general idea of the average composition and digestibility of feeding stuffs and of the extent of their variations. Somewhat later, so-called "feeding standards" were propounded in which it was attempted to formulate the amounts of the several nutrients best adapted to the various purposes of production. The general acceptance of this point of view was largely brought about by the writings of Wolff. The whole made a complete and simple system. So much is required for a certain purpose. This feed will furnish so much and the other so much. It is simply a question of arithmetic to work out a suitable combination, and a machine has even been devised for this purpose.

This system was introduced to the American public after it had assumed quite a definite form and it may be said in all fairness to still be, to a considerable extent, the basis of our theory. We question some of the standards, some of them we have modified, we hold them more flexibly than we once did, but protein, carbohydrates and fat are still the feeding trinity. Our theory of nutrition has become traditional, and has little pedagogic value for the student and little inspiration for the investigator. As a natural result it is more or less out of touch with practice, while our experiments, upon the theoretical side of the subject, have been "marking time."

With the publication of the results obtained by Zuntz and his associates upon the work of digestion, and of Kühn's and Kellner's respiration experiments at Moeckern, a new stage of progress was entered upon, to which I venture to hope that our own station in Pennsylvania has contributed a little. While the results of these investigations are best and most conveniently expressed in terms of energy, that is not the essential point. The vital thing is that in these experiments the amount of production due to each material experimented upon has been actually determined, with at least a fair degree of accuracy, by the laborious methods of the respiration apparatus or the respiration calorimeter. Enough results have already accumulated to show that many of the old values assigned to feeding stuffs vary widely from the truth. In particular these investigations have demonstrated the inaccuracy of the fundamental assumption upon which we have been basing our comparisons of feeding stuffs, viz, that digestible matter from different sources is equally valuable. For example, an experiment at the Pennsylvania Station showed the digestible organic matter of corn meal to be twenty-one per cent more efficient for maintaining a steer than the same amount of digestible matter from timothy hay, and fifty-six per cent more efficient for fattening. Kellner estimates the value of the digestible matter in numerous coarse feeds at only twenty to thirty per cent of

that of the digestible matter of grains, while Zuntz actually computes a negative result for the nutritive value of straw for the horse.

In the face of such differences as these, with what justification can we calmly continue to publish the old figures for digestible nutrients and to teach our students the conventional computation of rations?

Nor does it better matters much to add to our tables figures for the so-called "fuel values" of feeding stuffs.

In the first place, the figures commonly given are incorrect. They are based in most cases on Rubner's or Atwater's factors for human dietaries, and while these factors have been shown to be substantially accurate for the purpose for which they were intended, they have also been shown to be grossly inaccurate when applied to the digestible nutrients of stock feeds, the results being too high, in some cases by as much as twenty-five per cent.

In the second place, even if these energy values were correct, they do not help us much. We can not rejuvenate the old tables in this way. The writer is fully convinced of the advantages for many purposes of regarding nutrition problems from the standpoint of energetics, but it needs to be emphasized that the advantage of the calorie over the pound is simply as a measure. It is a better measuring stick than the pound, with a wider range of uses, but it is still a measuring stick—an implement—and the value of the results depends on what and how we measure. The prime failure of Henneberg's successors was not in the units which they used, but that they failed to measure the real nutritive effect of their feeds and rations, and we but repeat their failure when we seek to make progress by substituting these energy values for the equivalent amounts of matter. It is doubtless very desirable to know the amounts of digestible matter in feeding stuffs and the corresponding quantities of energy more accurately than we do at present, but neither the one nor the other by itself gives us any definite information as to the use made by the organism of the matter or energy supplied in the feed. It is only as we determine by the use of the respiration apparatus or calorimeter (or possibly by the comparative slaughter test) the actual changes brought about by the feed in the store of matter or of potential energy contained in the body that we can reach a scientifically accurate determination of the nutritive value of that feed. Unless we do this, no matter how accurately we analyze the feeding stuffs supplied or determine their energy, the second member of the equation is lacking. We stand in urgent need of actual determinations by modern methods of the nutritive values of feeding stuffs for different purposes, the results of which we may substitute for the assumptions on which we are now basing our teachings.

I may instance in particular the importance of determinations of

the maintenance values of feeding stuffs, in which a beginning has been made by the Pennsylvania Station. The results thus far reached hardly do more than show the need for further investigation. The experiments should be repeated with additional animals and extended to cover at least typical members of the different classes of feeding stuffs. Several years' work might be expended profitably on this single branch of the subject. Were this done we might fairly hope, I think, to secure approximate factors which could be applied to those feeds whose maintenance values had not been directly determined. If successful we should secure an indispensable factor for the discussion of the results of productive feeding, since it is evident that we must know how much of our ration has served simply for maintenance before we can rationally consider its productive value.

As regards the production values of feeding stuffs, we are better off, in that we have the results of Kellner's elaborate and exceedingly valuable determinations. For the feeding of mature fattening cattle it seems probable that the "production values" thus worked out may at least be regarded as a very close approximation to the truth. Here again, however, it is to be feared that we are in danger of repeating the mistakes of Henneberg's successors. Kellner has published a very complete table of actual or computed production values. It would not be surprising if there should develop a tendency to accept these values as measuring the worth of feeding stuffs for all productive purposes. In other words, there is danger that we may rest in an assumption instead of actually determining the facts for ourselves. The results of our Pennsylvania experiments certainly indicate that the values for maintenance are higher than those for production. It would not be at all surprising if the production values for different purposes or for different classes of animals should prove to be materially different. At any rate we have no warrant in advance of investigation for assuming that they are identical. We need similar determinations by equally rigorous methods of the productive values for other purposes, which are by no means necessarily the same as for fattening. Here, again, we have a vast field open to the qualified and patient investigator, equipped with the necessary appliances.

It may be objected that investigations such as those just outlined are to a degree empirical. They treat a single feeding stuff as an entity, while as a matter of fact it is not. We can determine the net available energy of a given sample of timothy hay, but we can hardly be said to determine the available energy of timothy hay. The justification for making such determinations lies in the fact that they promise to yield approximately correct and useful results within a reasonable time. Too great emphasis can hardly be laid upon the importance of studies of the physiological values of individual chemical ingredients. Such results, when once established, are definite, because they refer to

a definite substance, but on the other hand it will be a long time before a sufficient number of results of this sort are accumulated to furnish a sufficient basis for a science of feeding.

Finally, at least mention should be made of the importance of research upon the influence of condiments; that is, of the various flavoring and aromatic substances contained in feeding stuffs—what the Germans call Reizstoffe, which might be translated "stimulants," were it not for the unfortunate connotation of that word. We know that these substances exert an important influence upon the nutritive processes in the animal, but beyond this our knowledge is vague and qualitative.

The lines of investigation thus far suggested have to do with the relative values of feeding stuffs. The general applicability of any such results, however, has been questioned because of varying individuality in animals. That such variations, and striking ones, do exist is undeniable. It is not difficult, however, to suggest plausible explanations for them other than differences in the physiological utilization of the nutrients digested. For example, if of two animals one has a maintenance requirement five per cent greater than the other, due perhaps to greater restlessness of disposition, the quieter animal will do better than the more restless one upon a given ration, not because it uses its food physiologically to better advantage, but simply because it has more left for productive purposes after meeting the needs of maintenance. So too, if of two animals otherwise identical, one is able to consume continuously ten per cent more food than the other, it is obvious that a correspondingly larger proportion of its food is available for productive purposes, since the same amount must be subtracted for maintenance in both cases. I instance these simply as possible explanations without intending to assert that they or similar ones are sufficient to account for all the observed difference. The point is that the question is one needing investigation.

In the first place, the maintenance requirements of different species of animals, and their variation both as to proteids and total food, should be more fully investigated. At the present time, only the data for cattle can be regarded as fairly satisfactory. Such results are indispensable for the rational study of the results of practical feeding experiments. The influence of such factors as breed, individuality, age, weight, and condition on the maintenance requirement should be examined, as well as such external factors as the influence of the surrounding temperature and of the greater or less incidental activity of the animal. By careful methods much valuable information regarding the actual maintenance requirement of animals may be gathered by a combination of live weight and digestion experiments. When, however, we come to ask whether the maintenance value of a given feeding stuff, or in other words, the net availability of its energy,

varies with the animal to which it is fed, the aid of the respiration apparatus or calorimeter is indispensable.

We need also experiments upon the food requirements for production of various sorts. I can pause only to indicate a few of the problems under this head.

First, we have the proteid requirement. The question of the minimum proteid requirement has been brought to the fore by the investigations of Chittenden and others upon human nutrition. Since protein is usually the most expensive ingredient of rations, we need determinations of the actual amounts required, for instance, for growth at different ages. It would be interesting to determine whether there are individual differences in the rate of growth of proteid tissue, and whether this rate of growth can be stimulated by an excess of proteids in the ration. Similarly, for milk production, we attribute a stimulating effect to the proteid supply in excess of that appearing in the milk and excreta, but have we any real demonstration of such a fact? In the case of our working animals, we know that the work is done largely at the immediate expense of the nonnitrogenous nutrients, but have the proteids no function in the matter, and is the universal practice of athletes, for example, to consume large amounts of proteid food a mere habit or tradition and of no significance to us in the feeding of work animals? Questions such as those last indicated can, of course, be studied purely from the standpoint of the nitrogen balance of the body, but the history of investigations upon work production makes it evident that a comprehensive study of the subject requires also a study of the total metabolism, and this again necessitates the use of the respiration apparatus or calorimeter.

Variations in the total food demand due to individuality, age, weight, condition, and the like appeal for solution, and that solution can be reached only by accurate scientific methods. Similarly, in milk production the question of the factors influencing the distribution of the food between milk and tissue production needs thorough investigation. Again, the influence of such factors as temperature, water consumption, exposure to storms, humidity of the air, and the like needs be only mentioned to show the need for further systematic investigation.

Finally, a mere mention of the influence of feed upon the quality of the product must serve to simply hint at a most fertile field of investigation.

But because I have thus far dwelt almost exclusively upon the scientific and almost recondite aspects of the study of feeding, I would not be thought to hold that this is the only kind of work that ought to be undertaken or that no one should venture upon the field with any less formidable equipment than a digestion stall and an

Atwater bomb—not to say the heavy artillery of respiration apparatus and calorimeter. The sling may still prove a formidable weapon, if wielded by the hand of a David, and the smooth pebble from the brook may still do its wonted execution. It is largely a question of aim.

The discovery and establishment of natural principles and laws require the rigorous methods of physical and chemical research. By this path alone can we hope to attain a clear and definite quantitative conception of the processes of nutrition. But this alone is no more sufficient than the practical feeding experiment. We are dealing with an applied science, and our task is only half completed when we have established the fundamental principles of nutrition. We are under an equal obligation to show how these principles apply to the practical problems of feeding, and for this purpose nothing can take the place of actual experiments under the conditions of practice. If our practical experiments in the past have not been fruitful of general results it is not because they have been practical, but rather because they have not been so in the best sense. In too many cases they have lacked aim. They have not been informed by that comprehensive view of the whole subject which constitutes the essence of science, and so, addressing themselves to petty temporary or local questions, have, while admirable in their technical detail, failed to materially advance our knowledge. The more thorough and exhaustive our scientific studies of nutrition become, the greater will be our need for correlated practical experiments, scientifically planned to answer definite questions regarding the application in practice of the principles worked out in the laboratory or the respiration apparatus.

While this paper was in course of preparation, I received, from one of the leading investigators in animal husbandry in this country, a letter containing a number of inquiries regarding certain points in animal nutrition. If designed to reveal my limited knowledge of the subject, the letter was an unqualified success. To nearly all the inquiries I was compelled to return either conjectures or a simple "I don't know." I was, however, greatly interested in the letter from two points of view. In the first place, it illustrated the possibility of which I have just been speaking, namely, securing results of general value from practical experiments. The investigations which this gentleman has been carrying on have related primarily to questions of practice, yet he has been able to plan his experiments and study his results so as to give them an important bearing upon certain questions regarding the principles of nutrition. In the second place, the letter illustrates the inadequacy of the practical experiment alone and the necessity for scientific investigation along parallel lines. His experiments and experience raised questions which could not possibly

be answered by such experiments, and yet they were questions which he, as a practical man, found of importance. His results would be of very great value in confirming or checking the conclusions from scientific investigations, yet, taken by themselves, they were indecisive and capable of more than one interpretation.

Systematic studies of the practice of successful feeders should aid largely in this phase of the work. We might, I believe, find an important field for this sort of investigation in the feeding experiments recorded in the bulletins and reports of the stations. These experiments have been conducted and reported with far greater care than are or can be the operations of the practical feeder. Doubtless a wise criticism would have to be exercised in their selection and discussion, but they constitute an almost unworked mine of valuable material. To cite a single personal illustration, the writer has somewhat recently undertaken a comparison of a few of the more readily available station experiments upon the fattening of cattle with reference to the proteid requirements of such animals. The results need not be quoted here; it is sufficient to say that they showed a strikingly good general agreement, and to that extent seem calculated to furnish a good guide for practice. Had it been possible to make a systematic search of station literature, doubtless the available data might have been largely increased, but such an undertaking is usually beyond the means of the individual investigator.

This last suggestion leads naturally to the consideration of a related line of activity, namely, the compilation and critical discussion of the literature of animal nutrition in general, so far as it is of value to the stock feeder. As a matter of course, such study and compilation would accompany the scientific investigations already suggested, but in addition there is a vast amount of recorded data, both American and foreign, available, out of which much valuable information might be dug which would serve to check and correct our conclusions from small-scale experiments. The work needs to be done, but its volume almost discourages one from making an individual beginning. In brief, we need, parallel with scientific investigations into principles, a comprehensive sifting, working over, and systematizing of the facts already on record.

I have thus endeavored, after pointing out the economic importance of the subject, to indicate the unsatisfactory nature of our present knowledge regarding the principles of stock feeding, and the need of broadly planned investigations in this field, and have ventured the attempt to outline in general terms some of the investigations needed. There still remains to be considered the administrative question of how systematic investigations of the sort needed can be most effectively promoted, and this again is part of the broader question of how far fundamental investigations into principles can legitimately and reasonably be expected from our institutions for agricultural research.

No simple and categorical answer is possible to this question. Diverse conditions and abilities must always be reckoned with. At the same time, certain things may be suggested, with special reference to this particular subject but of more or less general application. It may be remarked, in the first place, that in any such undertaking, whether along the lines suggested by this paper or relating to other subjects, there is need for a degree of coordination of effort. I am well aware that I am here treading on delicate ground, but without stirring up smouldering fires, may we not freely and fully recognize the fact that, while duplication of work, of which we have heard so much, far from being discouraged should be encouraged, a certain common understanding of the broader features of the problem and of the most promising means of approach to it—to a degree, even a program—is essential to satisfactory progress?

The fact is we have been carrying on a guerrilla warfare around the edges of the subject. Indeed, in pessimistic moments, I have sometimes feared that our stations and colleges have been quite as successful in capturing prizes at fat-stock shows as in developing the science of feeding or imparting pedagogic value to the subject. What we need is to plan a campaign against the unknown. Let me hasten to add, however, that this military metaphor, like all others, should not be made to "go on all fours." It does not necessarily imply military discipline or a commander-in-chief. What is important at the present time is that there should be some means of inspiring and promoting serious and systematic work in this field, guided by a broad view of the subject.

The writer hopes to be able to contribute something to the progress of science along this line, and recognizes gratefully that circumstances have put greater opportunities at his disposal in some particulars than most of our investigators have hitherto enjoyed, but a few workers in a single institution seem like a forlorn hope when we contemplate the vast territory to be occupied. We need a dozen calorimeters instead of one. Above all, we need some means of guiding and to a degree coordinating the work of the younger men in our stations without depriving them of their initiative or of their individual credit for their investigations. Moreover, we need provision in some way for what may be called the drudgery of the work, for the computation of results, for the compilation of literature and other work of the sort.

How this shall be accomplished, I am far from undertaking to say. The stations as a rule, I think, appreciate the importance of the matter, but, as I took occasion to say recently in another connection, the pressure upon those in responsible charge of our experiment stations for results of immediate utility is such that it requires exceptional conviction and courage to set aside liberal sums for pure

scientific research. The U. S. Department of Agriculture has the advantage of a broader constituency, and to a certain degree, of larger freedom in its choice of subjects for investigation, yet, it too, perhaps even more than the stations, feels the pressure for popular approval. The problem is really one of educating our constituency.

It seems yet an open question how far it will prove possible for the experiment stations, with their pressing practical problems, to enter vigorously and aggressively into pure scientific research in the immediate future, either in this or other fields. The passage of the Adams Act has made this a live question, and it is most earnestly to be hoped that this fund will be used scrupulously in accordance with the spirit as well as the letter of the law, and that the reflex influence of this will extend to expenditures under the Hatch Act as well. State problems should be studied at the expense of the State and the national funds used for those broader investigations which are to benefit the whole country. It is to these funds and to those of the National Department of Agriculture that we must look for the promotion of comprehensive schemes of fundamental investigation whose results will become the common property of investigators everywhere.

I am inclined to see possibilities for larger service in this direction on the part of the U. S. Department of Agriculture than, I think, are some of my colleagues. Suppose, for example, that the Department were able to undertake a comprehensive scheme of investigation upon stock feeding corresponding to that which it is conducting so successfully in human nutrition. While the Department could hardly hope to find an Atwater to organize and direct the undertaking, yet with even a moderate degree of tact it surely ought to be able to attract the interest and confidence of the stations to its work, so that it would be to their manifest advantage to correlate their investigations with its own, whether officially or unofficially. For one, I can hardly doubt that such a course, patiently adhered to, without effort for notoriety and depending on moral authority alone, would be a powerful influence in favor of unity of work and of the study of fundamental questions by scientific methods, as well as in training men in the methods of investigation. That the same methods might be applied to quite other lines of investigation is, of course, too obvious to require mention. Indeed, it is a phase of the vexed question of cooperation which seems to me well worth careful thought—the essence of the method, of course, lying in the personality of its executor.

After all is said, however, it may be questioned whether, in the present temper of the public mind, the more abstract forms of scientific research can be adequately maintained by institutions dependent en-

tirely upon taxation for their support. The average taxpayer has come to have a considerable degree of confidence in scientific investigation, but he does not like long-term investments. He wants to see results, or at least the definite prospect of results, within a comparatively short time. This doubtless has its wholesome side as a discourager of dawdling and dilettanteism, but on the other hand the public has yet to learn that "the search for knowledge, with exclusive reference to its practical application, is generally unrewarded."

I believe that the question of the permanent endowment of research in agricultural science, either in special institutions or in our great universities, is a subject well deserving the consideration of all interested in agricultural progress, and that an investment of this sort would yield richer returns of honor and satisfaction to the donor than many a memorial pile or stately library.

Nor are the amounts required large as compared with the magnitude of the interests involved. Thus, to take the single subject of this paper, a sum sufficient not only to equip, but to permanently endow an institution for reseach in animal nutrition far superior to any now in existence anywhere would equal less than one-twentieth of 1 per cent of the value of our live stock and dairy products in a single year. Two cents per $100 upon the average value of the live stock handled yearly at the Union Stock Yards for the last five years would amply equip such an institution, and a liberal revenue for its maintenance would amount to 1 cent per head upon the cattle alone slaughtered yearly in Chicago. But the endowment of research in agriculture is too large a subject to be entered upon at the close of a paper of this length, and I forbear to tax your patience further.

I am conscious of having spoken with a certain degree of personal bias in urging as I have done the importance of, and necessity for, fundamental investigations in a branch of science in which I am deeply interested. For this I make no apology. If anything which I have said proves of service in promoting scientific investigation in any branch of agriculture, I shall feel amply justified.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

Quantitative volatilization of phosphoric acid, P. JANNASCH and E. HEIMANN (*Ber. Deut. Chem. Gesell., 39 (1906), pp. 2625–2628; abs. in Chem. Centbl., 1906, II, No. 17, pp. 1357, 1358; Jour. Soc. Chem. Indus., 25 (1906), No. 20, p. 1007*).—In the method proposed 0.5 gm. of phosphate is carefully heated in a flask in an open air bath with about 6 to 8 cc. of a mixture of 30 cc. of saturated cane sugar sirup and 10 cc. of sulphuric acid (1:1), a stream of air being passed through the flask until carbonization is complete and the mass is dry. The flask is then connected with a receiver and heated to the highest temperature it will bear, a stream of chlorin being passed through until no more condensable products come over. Oxygen is then substituted for chlorin until all carbon is burnt. After cooling, 3 to 4 cc. of the acid sugar solution is added and carefully spread over the inner surface of the flask and the above process repeated.

By this method the authors volatilized phosphoric acid completely from ammonium and magnesium phosphates. The extension of the process to other phosphates is being investigated.

The Woy method for the determination of phosphoric acid, G. B. VAN KAMPEN (*Chem. Weekbl., 3 (1906), pp. 576–579; abs. in Chem. Centbl., 1906, II, No. 17, p. 1357*).—The author maintains that this method is as accurate and satisfactory as the ordinary molybdic method. Like Woy, he finds the ignited residue to have a composition of $24MoO_3P_2O_5$. He considers Hundshagen's method unsuited to volumetric analysis on account of the slowness of filtration of the precipitate.

Process for rendering mixed combinations of phosphoric acid and silicic acid easily soluble, P. A. NEWTON (*English Patent No. 9183, Apr. 18, 1906; abs. in Jour. Soc. Chem. Indus., 25 (1906), No. 20, p. 997*).—In this process the raw phosphates are fused with artificial alkali silicates and lime in a regenerative Siemens' furnace and the molten product is run directly into cold water. It is stated that in the product thus obtained nearly all of the phosphoric acid is citrate-soluble.

Availability of phosphoric acid of the soil, G. S. FRAPS (*Jour. Amer. Chem. Soc., 28 (1906), No. 7, pp. 832–834; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 528, II, p. 702*).—A brief statement of the principal contents of this article will be found in E. S. R., 17, p. 611.

The determination of nitric acid in soils, E. GUTZEIT (*Landw. Vers. Stat., 65 (1906), No. 3–4, pp. 217–219*).—The inaccuracy of the determination of nitrates in presence of humus, as is done for example in Buhlert and Fickendey's method (E. S. R., 17, p. 832), is pointed out.

The determination of humus acids in soils by the Tacke method, C. K. VAN DAALEN (*Chem. Weekbl., 3 (1906), pp. 611–620; abs. in Chem. Centbl., 1906, II, No. 18, p. 1458*).—This method (E. S. R., 9, p. 32) is not considered reliable on account of the slow and often incomplete evolution of carbon dioxid.

The determination of small quantities of iron, W. McK. Marriott and C. G. L. Wolf (*Jour. Biol. Chem., 1 (1906), No. 6, pp. 451–461*).—The method proposed is based upon the color reaction which ferric salts show when treated with an alkaline thiocyanate. Acetone is recommended as a solvent and detailed directions are given for using the method in determining the iron in tissues and organic fluids, blood, urine, and inorganic substances.

Determining the crude fiber content of cocoa, W. Ludwig (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 3, pp. 153–159*).—The crude fiber content of a number of samples of cocoa beans, cocoa shells, cocoa sprouts, and commercial cocoa and chocolate were determined with a view to detecting adulteration. Cocoa from which the fat was not extracted was found to contain 3.71 to 4.42 per cent crude fiber, fat-free cocoa 4.98 to 5.96 per cent, and cocoa shells 14.47 per cent. The differences between the cocoa and cocoa shells are so great that determining the crude fiber content may serve as a means for the detection of undue amounts of shells in the ground cocoa.

The estimation of crude fiber in cocoa goods, H. Matthes and F. Müller (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 3, pp. 159–161*).—A comparison of methods.

Determining the digestible protein in feeding stuffs, A. Stutzer (*Jour. Landw., 54 (1906), No. 3, pp. 235–256, pl. 1*).—The determination of digestible protein in feeding stuffs and related questions are critically discussed on the basis of analytical and other data.

In the author's opinion the separation of proteid from nonproteid compounds by the aid of copper hydroxid is satisfactory, and he considers it immaterial whether a solution of copper hydroxid is used or whether a copper salt is used and the copper hydroxid formed during the analysis. In both cases care should be taken to keep the liquid slightly acid. This is done by using a few cubic centimeters of strong alum solution when copper hydroxid is used as a reagent and by using a little less sodium hydroxid than is necessary for the complete change of copper sulphate into copper hydroxid when the copper salt is used as a reagent.

A simple method of separating proteids of feeding stuffs from peptones is considered desirable since by the present method the peptones are not entirely precipitated by copper.

The pepsin soluble protein in feeding stuffs may be determined by treating for 48 hours at blood temperature 2 gm. of material with 500 cc. of gastric ferment prepared according to the author's earlier directions or 250 cc. prepared by the method described in the investigation reported below, the acidity of the solution being increased until it reaches 1 per cent of hydrochloric acid.

Such artificial digestion differs from natural digestion and so the author believes that the pepsin pancreatic method of determining digestibility should receive further study.

New experiments have shown that the results obtained by the pepsin method are not always the same as those obtained by natural digestion. The need of additional experiments on the nitrogenous metabolic products of the feces is insisted upon.

Studies on simplifying the method of estimating pepsin soluble constituents of feeding stuffs, A. Stutzer, H. Wangnick, and W. Rothe (*Jour. Landw., 54 (1906), No. 3, pp. 265–272*).—The conclusion is reached that the pepsin solution used in determining the digestible protein of feeding stuffs should be twice as strong as that commonly used, and directions are given for preparing such a reagent from fresh pig stomachs.

Estimating cellulose, lignin, and kutin in crude fiber, J. König (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 7, pp. 385–395*).—An extension of work previously noted (E. S. R., 17, p. 436).

The optical rotation of gliadin in certain organic solvents, W. E. Mathewson (*Jour. Amer. Chem. Soc., 28 (1906), No. 10, pp. 1482–1485*).—The optical rotation of purified gliadin was studied, methyl, ethyl, and propyl alcohols of different strengths, phenol, paracresol, glacial acetic acid, and benzyl alcohol being used as solvents.

The attempt was also made to estimate the gliadin present in flour by digestion with phenol and polarization of the filtered extract. "The results obtained seem to indicate that a quite complete extraction of the gliadin is effected. It is possible, however, that more or less glutenin also dissolves in the phenol. The chief difficulty encountered is in the filtration of the mixtures."

"The fact that gliadin is soluble in phenol would seem to render possible an approximate determination of its molecular weight by the freezing-point method."

The technique of the quantitative estimation of albumen by means of the precipitin reaction, A. Schulz (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 5, pp. 257–266*).—The author's investigations led to the conclusion that proteids may be estimated quantitatively in food analysis by biological methods—that is, by means of the precipitin reaction. He describes in some detail his method of procedure and gives a summary of references to other articles on the subject.

Fermentation changes occurring in Muscovado sugars, F. Watts and H. A. Tempany (*West Indian Bul., 7 (1906), No. 3, pp. 226–236, dgm. 1*).—The investigations showed that Muscovado sugar is liable to fermentative changes whereby the polarization is first increased and then decreased. These changes are considered due to micro-organisms. The rise in the polarization is due in part to the destruction of levulose and the subsequent fall to the destruction of dextrose and sucrose.

The estimation of cocoanut oil in butter fat, F. W. Harris (*Analyst, 31 (1906), No. 368, pp. 353–360*).—The presence on the market of cocoanut oil devoid of odor and practically neutral makes the determination of this substance of considerable importance. Different methods for this purpose have been tested in the author's laboratory for the past year.

According to the results obtained, the Bömer phytosterin acetate test (E. S. R., 16, p. 18) can not be used to distinguish between the adulteration of butter with cocoanut oil and with margarin. The method is expensive and tedious and is valuable only as a confirmatory test.

The Juckenack and Pasternack method (E. S. R., 16, p. 332) does not permit the detection with any certainty of less than 15 per cent of cocoanut oil.

By the Polenske method (E. S. R., 15, p. 850), which was subjected to careful and extensive examination, it is quite possible, in the opinion of the author, to detect the admixture of 10 per cent of cocoanut oil with a relative degree of certainty and to estimate fairly accurately an addition of 15 per cent. This method, which is simple and permits the determination of both the Polenske and Reichert-Meissl numbers in one operation, is recommended for general adoption.

The detection of cocoanut oil in butter, H. Lührig (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 10, pp. 588–592*).—Studies were made of the method of Wijsmann and Reijst (E. S. R., 17, p. 834). With pure butter the second silver index was often lower than the first. The author therefore concludes that the method is of no value.

On the extraction of fat from feces and the occurrence of lecithin, J. H. LONG (*Jour. Amer. Chem. Soc., 28 (1906), No. 6, pp. 704–706*).—Comparative tests showed that when fat of feces was extracted by the paper-coil method higher results were obtained than by the shell extraction with sand. "No reason is apparent why such differences should obtain where sufficient time is given." The coil method "commends itself on account of ease in manipulation and complete extraction. A perfectly clear ether extract is obtained, which, after evaporation, again dissolves readily in ether."

The phosphoric acid in the fat was determined in the samples studied and would indicate an excretion of 3 to 5.5 gm. of lecithin per day. In later tests smaller amounts were found. "With our present knowledge of the distribution of lecithin in animal and vegetable foods it is somewhat difficult to account for such values." It is pointed out that further experiments are needed.

Gravimetric estimation of saltpeter in meat, C. PAAL and G. MEHRTENS (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 7, pp. 410–416*).—A comparison of methods led to the conclusion that the gravimetric (nitron) method of estimating saltpeter in meat and meat products gives sufficiently accurate results, and the data obtained by this method agree well with those obtained by the gas-volumetric method of analysis.

Note on the examination of maple products. The lead value, A. P. SY (*Jour. Franklin Inst., 162 (1906), No. 1, pp. 71, 72*).—A modified method of estimating lead in maple sugars and maple sirups is proposed, lead acetate being precipitated by means of hydrochloric, nitric, and sulphuric acids, the lead sulphate, after the addition of alcohol, being removed by filtration and the lead determined as usual.

The quantitative estimation of ergot in flour, R. BERNHART (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 6, pp. 321–340*).—The method proposed depends upon the determination of the amount of chitin, a characteristic constituent of the ergot.

Practical guide for food chemists, G. PELLERIN (*Guide Pratique de l'Expert-Chimiste en Denrées Alimentaires. Paris: Maloine, 1906, vol. 1, pp. 680; rev. in Rev. Gén. Sci., 17 (1906), No. 16, p. 755*).—This volume is designed as a laboratory manual for the guidance of food chemists, and, in addition to full descriptions of analytical processes and methods, contains numerous tables and similar data.

Yearbook of chemistry, R. MEYER ET AL. (*Jahrb. Chem., 15 (1905), pp. XII+595*).—This is a review of the more important contributions to pure and applied chemistry during 1905. Biographical data are also included.

METEOROLOGY—WATER.

Monthly Weather Review (*Mo. Weather Rev., 34 (1906), Nos. 7, pp. 307–356, pls. 10, figs. 6, charts 8; 8, pp. 357–404, figs. 9, charts 6*).—In addition to the usual reports on forecasts, warnings, weather and crop conditions, meteorological tables and charts for the months of July and August, 1906, progress of climatology throughout the world, recent papers bearing on meteorology, recent additions to the Weather Bureau library, etc., these numbers contain the following articles and notes:

No. 7.—Studies on the Thermodynamics of the Atmosphere—VI, The Waterspout Seen off Cottage City, Mass., in Vineyard Sound, on August 19, 1896 (illus.), by F. H. Bigelow; Climatology of Porto Rico from 1867 to 1905, inclusive, by W. H. Alexander (see p. 526); A New Form of Precision Barograph (illus.), by C. F. Marvin; Snow Rollers (illus.), by W. A. Bentley; Snow

Rollers at Mount Pleasant, Mich. (illus.), by R. D. Calkins; Progress of Meteorology in Australia; George J. Heck; Physical Societies and Journals; and Weather Bureau Men as Educators.

No. 8.—The International Symbols, by H. H. Clayton; The Meteorological Optics of Prof. J. M. Pernter (illus.), by R. W. Wood; Eiffel's "Etudes Pratiques;" Studies on the Thermodynamics of the Atmosphere—VII, The Meteorological Conditions Associated with the Cottage City Waterspout (illus.), by F. H. Bigelow; Variation in Temperature Over a Limited Area (illus.), by W. I. Milham; The First Daily Weather Maps from China (illus.), by C. F. Talman; What is Research; The International Seismological Association; and Astronomy versus Meteorology.

Climatology of Porto Rico from 1867 to 1905, inclusive, W. H. ALEXANDER (*Mo. Weather Rev., 34 (1906), No. 7, pp. 315–324*).—This article supplements a previous report on the same subject, giving additional data regarding topography, which is based upon a bulletin of the U. S. Geological Survey, previously noted (E. S. R., 12, p. 795), and tabulated summaries of observations on temperature, rainfall, etc., at a number of places in Porto Rico, observations at San Juan, Canóvanas, and Perla being given in some detail.

The data show a very uniform temperature, with no excessive extremes, the annual range rarely being 50°. January shows the coldest mean temperature and August the hottest, the difference between the two, however, being only 5.1°. The extreme maximum temperature usually occurs in May. The mean temperature of the period from December to April is below the annual mean of the rest of the year above. The average daily range of temperature at San Juan is between 11 and 12°, although at interior stations a much greater range is recorded. The minimum daily temperature occurs about 5 a. m., the maximum from 10 a. m. to 2 p. m. The temperature decreases about 4° for each 1,000 ft. of elevation.

A well-defined dry season occurs from about November 20 to April 15, February being the driest month. The average number of rainy days is 194 at Canóvanas, 208 at San Juan, and 260 at Perla. The average rainfall for the east coast is 92 in., for the north and west sides 86, for the south side 57. The rainfall in general decreases westward to the middle of the Island and then rapidly increases. The south side is subject to long droughts, making irrigation necessary.

The steady northeast trade winds, light at night and fresh during the day, make the evenings cool and even the hottest days less oppressive. The island is out of the usual path of hurricanes and these are comparatively rare. Thunderstorms and hailstorms are infrequent and rarely violent.

Climatological atlas of India, J. ELIOT (*[Calcutta]: Indian Met. Dept., 1906, pp. XXXII, pls. 120; rev. in Nature [London], 75 (1907), No. 1941, pp. 241–244*).—This atlas consists of 120 colored maps showing in great detail the distribution of the meteorological elements over the Indian Empire, with an introduction giving "a brief history of the progress of the work of meteorological observation in India and hence of the growth of the Meteorological Department, a list of the observatories contributing observations that have been utilized in the preparation of the atlas with their position and elevation, and a brief explanation of the charts."

The maps are based upon the results of observations during the first 25 years' operation of the Meteorological Department of India, beginning with the year 1875–76 and covering the incumbency of Sir John Eliot, and are classed as general, pressure and wind charts, temperature maps, humidity charts, cloud plates, rainfall maps, and storm track charts. The work is reviewed in *Nature* by J.

Hann, who refers to it as the most comprehensive statistical and scientific meteorological record in the world.

The effect of the sea upon climate (*Sci. Amer., 95 (1906), No. 8, pp. 130, 131*).—Examples are briefly cited to show that "the enormous area of the sea has a great effect upon climate, but not so much in the direct way formerly believed. While a mass of warm or cold water off a coast must to some extent modify temperature, a greater direct cause is the winds, which, however, are in many parts the effect of the distribution of warm and cold water in the ocean perhaps thousands of miles away."

Sunrise, moisture, and growth, H. E. RAWSON (*Transvaal Agr. Jour., 4 (1906), Nos. 15, pp. 558–566, pls. 3, fig. 1; 16, pp. 743–754, pl. 1; 5 (1906), No. 17, pp. 140–148, figs. 2*).—Observations and experiments on various plants are reported which lead to the conclusion that in regions of little cloud and excessive sunlight, as is the case at Pretoria, Transvaal, the early sun's rays are especially active in stimulating the growth of plants and indicate the desirability of so planting crops that they may utilize to the fullest extent such rays and be protected from excessive sunlight.

The author states the belief "that, besides rain, heat, soils, and all the well-recognized factors which enter into the question of growth, there are some subtle influences at work which have hitherto been little, or not at all, taken into account."

In commenting upon these conclusions H. Ingle and I. B. Pole Evans discuss the principal factors influencing plant growth in their bearing upon the deductions set forth, concluding that the results upon which the deductions are based "may be explained by the effects of temperature changes, and without attributing any occult influence to the morning sunshine per se. . . .

"One important conclusion may be deduced from the considerations discussed in this review—that many plants would be benefited by being shaded from the hot midday sun, thus often preventing them from being heated above their maximum temperature for growth. . . .

"It is probable that sunrise light contains a sufficiency of orange and yellow rays to produce rapid carbon assimilation, while the blue and violet rays, which tend to reduce growth, are relatively deficient.

"The unscreened plants, receiving such rays at a period when their temperature is favorable for the performance of their vital functions, thus have an advantage over their screened neighbors, which do not receive such strong light until later in the day, when their temperature is quickly raised to a point not so favorable for assimilation, but more favorable to the respiratory processes by which their tissues are oxidized and diminished."

Results of meteorological observations, 1905, R. HEINRICH, M. HABERLAND, and H. KÖNIG (*Arch. Ver. Freunde Naturgesch. Mecklenb., 59 (1905), 2. Abt., tables facing p. 252, chart 1*).—Summaries are given of observations on temperature, pressure, precipitation, humidity of the air, cloudiness, duration of sunshine, etc., at the agricultural experiment station at Rostock; of observations on temperature, pressure, humidity, precipitation, cloudiness, etc., at the meteorological station at Neustrelitz; and on duration and photochemical properties of sunshine at Neubrandenburg.

Swedish meteorological observations, 1905, H. E. HAMBERG (*Met. Iakttag. Sverige* [*Observ. Mét. Suéd.*], *K. Svenska Vetensk. Akad., 47 (1905), pp. X + 157*).—This report is divided into 3 parts, (1) daily observations at 18 stations of the second order, (2) monthly and annual summaries of all the meteorological elements furnished by 39 stations of the second order, and (3) 5-day means of temperature at the 39 stations included in part 2.

Meteorology (*An. Estad. Mexicana, 12 (1904), No. 12, pp. 27–42*).—This report gives summaries of meteorological conditions as observed at the City of Mexico during 1904, and at a number of other places in the Republic of Mexico, with a discussion of seasonal variations in weather conditions.

Hourly meteorological and magnetic observations, Manila central observatory, 1904 (*Ann. Rpt. Philippine Weather Bur., 1904, pts. 1 and 2, pp. 208, charts 2*).—This report records in part 1 the results during 1904 of hourly observations at the central observatory at Manila on atmospheric pressure, temperature, relative humidity, vapor tension, direction and force of the wind, and direction, form, and amount of clouds, and bi-daily observations on ozone; and in part 2, observations during the same period at the magnetical observatory on declination, horizontal force, inclination, and other disturbances, as measured by Mascart registering instruments.

Precipitation in North German river basins, G. HELLMANN (*Die Niederschläge in den Norddeutschen Stromgebieten. Berlin: Dietrich Reimer, 1906, vols. 1, pp. V + 386 + 139, pls. 3, figs. 48, map. 1; 2, pp. VII + 722; 3, pp. VII + 872*).—A review of this work in *British Rainfall, 1905*, refers to it as "the most remarkable compendium of rainfall data which has ever been published." It is a compilation, under the direction of the chief of the Royal Prussian Meteorological Institute of Berlin, of all available rainfall data up to the year 1900, the earliest records included dating back to 1715.

Observations at 4,000 stations are included. The data are discussed with reference to amount, frequency, and variation of rainfall.

A study of the longest records reduced to their average value for the 50 years 1851–1900 shows that the lowest mean annual rainfall in the region under consideration is about 18 in., the greatest about 58 in.

The average seasonal changes for the whole region are comparatively regular, February having as a rule the least rainfall and July the greatest, with a regular decrease following that month. Under the maritime conditions of the western part of the area, however, there is a tendency for the maximum to occur later in the year, in the extreme south and southeast to occur earlier. Over southern and central Germany the driest month is January, in the northeast February, and in the extreme north and northwest April. The rainfall of winter is 24 per cent of the annual total in the extreme west, diminishing steadily toward the east and south until it becomes less than 16 per cent at the sources of the eastern rivers. In the spring the rainfall increases from about 18 per cent of the total in the northwest and 20 per cent along the Baltic coast to more than 24 per cent in the valley of the Danube. The summer rainfall is 30 per cent of the total annual rainfall on the North Sea coast and 40 per cent in the heart of the continent. In autumn 30 per cent of the total rainfall occurs along the North Sea and Baltic coasts and 22 per cent in the central and southern states.

Leaving the mountainous regions out of account, the number of rainy days decreases from about 175 in the northwest of Germany to 135 or less in the southeast, the variations in different parts of Germany being somewhat irregular. In the north and west the months which have most frequent rains are October, November, or December, and the month having the least frequent rains April. In central Germany most frequent rains occur in July and least frequent usually in September. In the south June has most rainy days and November or January least.

In a study of variations in rainfall it was found that there was a greater tendency for a run of consecutive dry months than for a run of consecutive wet months. A relation was traced between variations in annual rainfall and sunspot frequency, each sunspot period including 2 rainfall maxima, closely

related to the turning points of the sunspot curve, the larger maximum of rainfall corresponding to the sunspot minimum, the smaller to the sunspot maximum. A 35 years' cycle corresponding to that deduced by Brückner for the whole of Europe seemed to be borne out by the data for North Germany.

A voluminous bibliography of literature relating to German rainfall is given.

Cirrus clouds and rain (*Science, n. ser., 24 (1906), No. 624, p. 785*).—A brief note is given on studies by Vanderlinden at the Royal Observatory of Belgium at Uccle on the relation between the direction of movement of cirrus clouds and the subsequent occurrence of rain. The observations show in general that cirrus clouds "do not appear always to be the prognostics of rain which they have been said to be."

The Mount Rose weather observatory, J. E. CHURCH, Jr., (*Mo. Weather Rev., 34 (1906), No. 6, pp. 255–263, figs. 9*).—An account is given in this article of the establishment, with the cooperation of the Nevada Academy of Sciences, the United States Weather Bureau, and the Nevada Agricultural Experiment Station, of a small observing station on the summit of this mountain which forms the northern apex of the Carson Range of the Sierra Nevada and is 10,800 ft. high. The peak is near Reno, Nev., and commands the Lake Tahoe and Truckee and Carson valleys. It was selected because it was believed "that an observatory here would be of service in furnishing data as to the constant air movements from the Pacific coast and in reporting approaching weather conditions to the districts farther east," and would furnish a valuable means of comparing the weather conditions of this high elevation with those of Reno in the valley, 6,268 ft. below, and of San Francisco to the southwest.

The records thus far made indicate a rather constant correspondence between fall in pressure and fall in temperature, and furthermore, that such fall precedes by several hours (24 to 36) the appearance of frost in the Truckee and Carson valleys below, thus furnishing a possible basis for frost prediction for these valleys.

In cooperation with the Nevada Experiment Station it is proposed to continue these frost studies and also to make investigations on precipitation and evaporation at this high altitude as well as of other problems having an agricultural bearing.

Water supply and sewerage (*Ann. Rpt. Bd. Health Mass., 37 (1905), pp. 33–426, figs. 3, charts 3*).—This report contains as usual accounts of advice given to cities, towns, and public institutions regarding water and ice supply, sewerage and sewage disposal, pollution of ponds, streams, and other bodies of water, etc., the results of examinations of public water supplies and rivers, and water supply statistics, as well as articles on materials used for service pipes in Massachusetts, experiments on the removal of organisms from the waters of ponds and reservoirs by the use of copper sulphate, investigations concerning absorption and sedimentation of copper sulphate used as an algicide and concerning the bactericidal properties of copper and copper sulphate, experiments on the purification of sewage and water at the Lawrence Experiment Station in 1905, and examination of sewer outlets and of tidal waters and flats from which shellfish are taken.

Experiments with copper sulphate on ponds and reservoirs (pp. 207–287).—Experiments on a number of ponds and reservoirs with varying amounts of copper sulphate are reported, showing that the sulphate completely destroys certain kinds of organisms but has little or no effect on others. "The Cyanophyceæ, which are among the most troublesome of the organisms which cause disagreeable tastes and odors in the waters of ponds and reservoirs, can be removed by the application of copper sulphate in a quantity amounting approximately to 1 part of copper sulphate in 4,000,000 to 8,000,000 parts of water." Uroglena

of the Infusoria, which are very troublesome organisms in connection with water supplies, was removed by the use of copper sulphate at the rate of 1 part to 12,000,000 parts of water. The results, however, were not so satisfactory in case of Diatomaceæ and green algæ. Moreover, it appears that after repeated treatment with copper sulphate such organisms become less sensitive to its action. Under certain conditions copper sulphate seems to be very injurious to fish. In one case reported 1 part of sulphate in 5,000,000 parts of water destroyed large numbers of fish. There are conditions in both shallow and deep ponds and reservoirs under which the diffusion of the copper is very irregular and may remain for long periods locally concentrated.

The use of copper and copper sulphate as a bactericide, etc. (pp. 289–338).—Tank and reservoir experiments on the use of copper sulphate and metallic copper as a means of destroying bacteria, algæ, etc., as well as studies of sedimentation of copper sulphate, its combination with mineral and organic matters, etc., are reported in this article. The results show among other things that while *Bacillus coli* and *B. typhosus* are occasionally killed by dilute solutions of copper, these organisms may live for many weeks in water containing not more than 1 part of copper sulphate in 100,000 parts of water. It is claimed that to insure the destruction of these germs 1 part of copper sulphate to 1,000 parts of water must be used, and such an amount of copper gives a strongly astringent taste to water. "In some instances, very dilute solutions of copper sulphate, or colloidal copper absorbed from contact with clean metallic copper, appear to have a decidedly stimulating effect on bacterial activity, causing rapid multiplication. . . . The two experiments made with sulphate of alumina and ferrous sulphate seem to indicate that these salts are about as efficient in destroying bacteria as copper sulphate."

In view of the uncertainty of the action of the copper sulphate under many conditions, it is stated "that the use of any method of sterilization which is not absolutely sure and effective is dangerous in ordinary hands, tending to induce a false feeling of security, and leading to the neglect of ordinary precautions which otherwise would be taken."

The use of copper in the purification of water, L. F. Rettger and H. B. Endicott (*Engin. News, 56 (1906), No. 17, pp. 425, 426*).—Experiments are reported from which the conclusion is drawn that "in the absence of appreciable quantities of organic matter (and an unusual amount of carbonates) and when the temperature is not too low (8–10° C.), copper sulphate has a strong germicidal action on *Bacillus coli*, *B. typhi*, the organisms of dysentery and Asiatic cholera, and on hog and fowl cholera bacilli. At 20° C. they are destroyed in dilutions of 1 to 400,000 and over, within a period of 24 hours. In the natural condition of water in reservoirs, etc., the action is in all probability much greater. When used intelligently, therefore, copper sulphate is a most valuable agent in the purification of drinking water. It has been shown frequently that small quantities of copper have no injurious action on man. Certain fish may be injured by it, but only in concentrations much greater than those which are necessary to destroy the typhoid organism, etc."

Sulphate of iron and caustic lime as coagulants in water purification, J. W. Ellms (*Engin. Rec., 54 (1906), No. 16, pp. 439–441, fig. 1*).—The use of these materials is discussed and their advantages explained. Of the latter the principal are rapid sedimentation in turbid waters and consequent elimination of plain sedimentation, diminished cost of purification, and a high degree of efficiency, especially in the case of the turbid waters of the Middle West.

Water softening and treatment, W. H. Booth (*London: Archibald Constable & Co., Ltd., 1906, pp. 324; rev. in Chem. News, 94 (1906), No. 2435, p. 46*).

SOILS—FERTILIZERS.

Agricultural charts at the Congress of Applied Chemistry, Rome, 1906 (*Rev. Gén. Agron., n. ser., 1 (1906), No. 6–7, pp. 254–256*).—This is a review of a discussion of this subject by Proost.

The relation of plants to the composition of the soil and the association of certain plants with a particular kind of soil under natural conditions are discussed with reference to the utilization of such knowledge in the preparation of agricultural charts. A permanent committee of specialists in various lines was appointed to take this subject under consideration and to compile materials for the preparation of such charts.

On the relation between soils and the rocks from which they are derived, L. MILCH (*Mitt. Landw. Inst. Breslau, 3 (1906), No. 5, pp. 867–897*).—The studies here reported of soils produced under natural conditions at different stages of weathering from rocks of various kinds led to the conclusion that from the standpoint of soil formation the mineralogical constitution is the most important characteristic of the soil-forming rocks; that similar rocks may often in the course of weathering yield very dissimilar soils and vice versa, for example, such petrogenetically dissimilar rocks as granite and metamorphosed gneiss may at certain stages of decomposition yield like soils, and that the tendency is in all cases toward final uniformity of decomposition products and similar soils even when the original rocks were of very different character.

Oxidation in soils and its relation to productiveness, F. V. DARBISHIRE and E. J. RUSSELL (*Chem. News, 94 (1906), No. 2443, p. 137*).—A brief abstract of a paper read before the 1906 meeting of the British Association at York (see also E. S. R., 17, p. 536).

The phospho-humic compounds of the soil, J. DUMONT (*Compt. Rend. Acad. Sci. [Paris], 143 (1906), No. 3, pp. 186–189; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 527, II, p. 626*).—The author briefly reports the results of experiments in precipitating alkaline humate in the presence of solutions of phosphoric acid and phosphates and determining the composition of the precipitate. He concludes from the results obtained that well-defined phospho-humic compounds are formed partly by the absorbent action of humus on the soluble phosphates in the soil solutions and partly by the reaction of these phosphates on the alkaline humates naturally produced by chemical action in cultivated soils.

Potassium humate absorbed 6.1 per cent of phosphoric acid when treated with a solution of this substance and larger amounts when treated with a solution of monocalcium phosphate. Humus precipitated in presence of dipotassium phosphate by a number of different acids contained about the same amount of phosphoric acid in each case and the percentage of this substance remained constant whatever the excess of phosphate added.

Studies on the soils of the northern portion of the great plains region. The second steppe, F. J. ALWAY (*Amer. Chem. Jour., 36 (1906), No. 6, pp. 580–594*).—The region referred to in this article "includes the whole eastern portion of the great plains, properly so-called, of Canada," of which the average elevation is 1,600 ft.

Analyses of samples of each foot of the soil down to a depth of 6 ft., taken at the Indian Head experimental farm, are reported, and while these analyses show the soil to be fertile, it is stated that there is nothing in the analytical results to explain the remarkable yields of wheat, oats, barley, peas, and potatoes which have been obtained.

The surface soil is rich in nitrogen (0.23 per cent in first foot) and both surface and subsoil are well supplied with potash (0.37 to 0.6 per cent) and phosphoric acid (0.14 to 0.18 per cent). The subsoil is also very rich in carbonates.

A study of moisture conditions in the soil leads to the conclusion that it is the moisture stored in the deep and permeable subsoil during the previous summer and not the frost of the preceding winter, as claimed by Sir Wm. Crookes and others, that is the cause of the high yields. The relative fertility of different areas of the soil seems to depend more upon the character of the subsoil as related to storage of moisture, etc., than upon that of the surface soil.

On the agricultural value of the cacao soils of St. Thomas and the Gold Coast, A. HÉBERT (*Bul. Soc. Chim. Paris, 3. ser., 35 (1906), No. 20–21, pp. 1039–1041; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 530, II, p. 889*).—Physical and chemical analyses of a number of samples are reported. It is stated that in common with African soils in general the soils examined showed a marked deficiency of lime and potash, although nitrogen and phosphoric acid are usually present in sufficient amounts.

On the soils of the middle buntersandstein, E. BLANCK (*Landw. Vers. Stat., 65 (1906), No. 3–4, pp. 161–216, pl. 1*).—A geological and chemical study of this subject is reported, with a review of literature.

The results of examination of a number of soils of this group with reference to physical, chemical, petrographic, and mineralogical properties, and absorptive power for potash, phosphoric acid, and nitrogen, are reported, and the stages in the formation of such soils and their modification by the use of fertilizers are discussed.

Management of soils to conserve moisture, G. H. FAILYER (*U. S. Dept. Agr., Farmers' Bul. 266, pp. 30, figs. 7*).—This bulletin is a popular discussion of the subject of conservation of moisture in soils with special reference to semi-arid conditions, its preparation being suggested by the increasing interest taken in the question of dry farming in parts of the semi-arid West. It discusses briefly general principles, and deals more fully with the relation of drainage and tillage to soil moisture, conditions in the semi-arid regions and best method of controlling them, crops best suited to such regions, and the relation of organic matter to the conservation of moisture in soils.

Soil differences, J. A. BONSTEEL (*Cornell Countryman, 4 (1906), No. 3, pp. 68–70*).—This article briefly discusses differences in texture, structure, organic matter, moisture relations, and drainage of soils.

On Loew's theory regarding the lime-magnesia ratio in soils, J. C. DE RUIJTER DE WILDT (*Cultura, 18 (1906), Nos. 216, pp. 463–471; 217, pp. 505–513; 218, pp. 557–570; 219, pp. 650–666*).—Investigations on this subject are critically reviewed and the conclusion is reached that these investigations do not demonstrate that a definite relation between lime and magnesia is necessary to normal nutrition of plants, although it is not denied that a relation may exist. Further investigation of the subject is required.

The removal of black alkali by leaching, F. K. CAMERON and H. E. PATTEN (*Jour. Amer. Chem. Soc., 28 (1906), No. 11, pp. 1639–1649, figs. 5; abs. in Chem. Abs., 1 (1907), No. 1, pp. 79, 80*).—This article reports analyses and percolation tests with 2 samples of black alkali soils, one from North Yakima, Wash., the other from Fresno, Cal.

The analyses showed that these samples of alkali contained besides the soluble carbonates notable quantities of sodium sulphate with much smaller amounts of other sulphates and chlorids. One hundred grams of each soil was placed in a paraffined brass tube connected below with a short section of a Pasteur-Chamberland filter tube, and distilled water was allowed to percolate through the soil

under a constant pressure of $6\frac{1}{2}$ ft. The volume and time of flow of each percolate was measured, its electrical conductivity was taken, and its chemical composition was determined.

The conclusions reached from the results obtained were as follows:

"(1) Neutral salts such as the chlorids in the presence of carbonates can be comparatively readily and completely leached from the soil.

"(2) With continued leaching of soils containing 'black alkali' there is an increase in the rate at which percolation takes place, due probably to the reduction of the amount of alkali present and its effect on the physical structure of the soil.

"(3) With continued leaching there is a comparatively rapid reduction of normal carbonates in the soil water, due in large measure to conversion into bicarbonates.

"(4) Bicarbonates are rapidly removed at first and then continue to be slowly removed in the soil water in very small amounts, diminishing so slowly as to be practically constant for an indefinite period.

"(5) Soils containing 'black alkali' can be reclaimed by leaching, but the time and the amount of water required are probably much greater than in the case of 'white alkali.'"

The decrease of soil temperature with elevation in the Prologh Mountains in Dalmatia, F. von Kerner (*Met. Ztschr., 23 (1906), No. 9, pp. 421, 422*).—Decreases of from 0.38 to 0.75° for each 300-meter increase in elevation were observed.

Notes on carbon bisulphid, its action on the lower plant organisms as well as the fertility of soils, B. Heinze (*Centbl. Bakt.* [*etc.*], *2. Abt., 16 (1906), No. 10–13, pp. 329–358; abs. in Chem. Centbl., 1906, II, No. 8, p. 699*).—Previous investigations on this subject are reviewed and experiments by the author are reported which indicate that the beneficial effects observed in the case of applications of carbon bisulphid to the soil may be in a measure obtained by green manuring with mustard, which supplies to the soil certain sulfur carbon derivatives which have a similar action to carbon bisulphid in promoting the activity of nitrogen-fixing organisms. A bibliography of 24 references to the literature of the subject is appended.

The utility of earthworms in agriculture, E. de Ribaucourt and A. Combault (*Abs. in Rev. Gén. Agron., n. ser., 1 (1906), No. 9, pp. 374–384*).—This is a review of observations and investigations showing the important part which earthworms (Lumbricus) play in improving the chemical and physical properties of soils.

Some contributions to the microbiology of soils, B. Heinze (*Centbl. Bakt.* [*etc.*], *2. Abt., 16 (1906), Nos. 20–21, pp. 640–653; 22–23, pp. 703–711; abs. in Chem. Centbl., 1906, II, No. 10, p. 903; Jour. Chem. Soc.* [*London*], *90 (1906), No. 527, II, pp. 625, 626*).—The literature of the fixation of the free nitrogen of the air by lower organisms and the assimilation of free nitrogen by algæ is reviewed.

The author's experiments indicate that in general pure cultures of the algæ did not fix nitrogen in large amounts, although there was rapid fixation when the cultures of the algæ were inoculated with Azotobacter or other nitrogen-fixing organisms. The author concludes in general that the importance of algæ in relation to nitrogen fixation of the soil depends mainly upon the fact that they furnish a valuable and readily available supply of carbon compounds for the assimilation of the nitrogen-fixing organisms, especially Azotobacter.

Conditions affecting legume inoculation, K. F. Kellerman and T. R. Robinson (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 100, pt. 8, pp. 15, pls. 2*).—The bulletin records the results of greenhouse studies on soils from different

parts of the United States, of the relation of lime, character of soil solution, heavy inoculation, aeration, and associative action of bacteria on the efficiency of legume inoculation. The results are thus summarized:

"(1) Lime is of decided benefit in obtaining successful inoculations of legumes in some soils. These soils often show an acid reaction to litmus.

"(2) Soil extracts serving as culture media often indicate the probable success of inoculating a leguminous crop. This, however, may not always hold true.

"(3) At least during the first season's growth no general cross-inoculation takes place. Bacteria from one host may, however, inoculate a physiologically related species.

"(4) Heavy inoculation by a pure culture increases nodule formation if the soil solution is enriched by the excess of culture medium; however, in a favorable soil a light inoculation well distributed is as effective.

"(5) Thorough aeration is favorable to nodule formation.

"(6) Whether in a synthetic medium or a natural soil solution, the functions of a bacterium are influenced by the associative or competitive action of the various groups of organisms with which it comes in contact, as well as by the nature of the culture material."

Experiments with nitrogen-assimilating bacteria, A. BRUTTINI (*Bol. Quind. Soc. Agr. Ital., 11 (1906), No. 18, pp. 658–664*).—The work of other investigators on this subject is reviewed, and experiments by the author with Moore's cultures are reported. These show that while the cultures were effective when the soil was not naturally inoculated, so few cultivated Italian soils are in this condition as to render the practical value of artificial inoculation doubtful.

On some new nitrogen bacteria with autotrophic habits of life, H. KASERER (*Ztschr. Angew. Chem., 19 (1906), No. 40, p. 1681*).—This is a brief note on a paper on this subject presented at the recent meeting of the German Association of Naturalists and Physicians.

The author isolated and describes two organisms which oxidize ammonia compounds. The first, to which the name *Bacillus nitrator* is given, transforms ammonia compounds directly into nitrate without the intermediate formation of nitrite; the other, *Bacillus azotofluorescens*, oxidizes ammonia, setting free nitrogen without the intermediate formation of either nitrite or nitrate.

On the chemical processes involved in the assimilation of elementary nitrogen by Azotobacter and Radiobacter, J. STOKLASA (*Ztschr. Ver. Deut. Zuckerindus., 1906, No. 608, pp. 815–825*).—Culture experiments with these organisms, singly and combined in various culture media to determine their capacity for fixing free nitrogen and the conditions which favor this process are reported. In a medium containing 20 gm. of mannite and 0.5 gm. of potassium phosphate per liter Azotobacter assimilated 75 mg. of nitrogen per liter in 10 days, 90 mg. in 15 days, and 125 mg. in 20 days. Radiobacter cultures showed practically no gain in nitrogen, and mixtures of the two organisms showed less gain than Azotobacter alone. Glucose proved a better source of carbon than mannite, provided a little calcium or sodium carbonate was added to the medium. In a glucose medium Azotobacter fixed 180 mg. of nitrogen per liter in 15 days, in which time the glucose was entirely used up. On the average 165 gm. of glucose was required for 1 gm. of nitrogen assimilated. No soluble nitrogen compounds were formed in the cultures. The bacterial mass contained 10.2 per cent total nitrogen and 8.6 per cent pure ash, the latter containing 62.35 to 58 per cent of phosphoric acid. The nitrogen and phosphorus in the bacterial mass was mainly in the form of nucleo-proteid and lecithin. Measurements of the carbon dioxid evolved showed a very large evolution of this gas, the highest production being observed at from the fourth to the sixth

day. The rate of evolution was 1.2729 gm. of CO_2 per gram of dry matter in the bacterial mass, in 24 hours, a rate much higher than that found in the case of *Bacterium hartlebi* (0.6 gm.) and *Clostridium gelatinosum* (0.18 gm.).

The author found carbon dioxid, hydrogen, alcohol, and lactic, acetic, and formic acids to be produced by the breaking down of the mannite or glucose of the media and he believes that these changes are brought about in presence of an abundance of oxygen by the action of a glycolytic enzym which he has isolated from cultures of *Bacterium hartlebi.*

The fixation of atmospheric nitrogen (*Engineer* [*London*], *102* (*1906*), *No. 2647, pp. 285, 286*).—A summary is here given of papers and a discussion by Nernst, Foerster, Le Blanc, Klaudy, Frank, Brode, and other electro-chemists at the thirteenth annual meeting of the German Bunsen Society, held at Dresden May 20 to 23, 1906, the fixation of atmospheric nitrogen being the special subject selected for discussion at this meeting.

The principal papers presented and discussed were as follows: Two papers on the general subject of the fixation of atmospheric nitrogen, by Foerster and Le Blanc; the equilibrium and reaction velocity ratios for nitric oxid formation, by Nernst; technical methods for carrying out the combustion of nitrogen, by F. Foerster; and technical methods for converting the nitrous gases into nitric acid and its salts, by Klaudy.

Researches on the direct synthesis of nitric acid and of nitrates from their elements at ordinary temperature, M. BERTHELOT (*Compt. Rend. Acad. Sci.* [*Paris*], *142* (*1906*), *No. 25, pp. 1367–1379; Ann. Chim. et Phys., 8. ser., 9* (*1906*), *Oct., pp. 145–163; abs. in Jour. Soc. Chem. Indus., 25* (*1906*), *No. 14, p. 695; Chem. Abs., 1* (*1907*), *No. 1, p. 22; Bul. Soc. Chim. Paris, 3. ser., 35* (*1906*), *No. 23, pp. 1221, 1222*).—The author reports studies of the effect of silent discharges of the induction coil on mixtures of nitrogen and oxygen in presence of water or alkali hydroxid operating on a stream of gas passing through the apparatus and also on a fixed contained volume of gas.

"The primary current was 12 amperes at 6 volts, and the poles of the coil were 20 mm. apart. The coil was used both with and without a condenser. It was found that the high tension of the coil was necessary (no effect was produced by connecting the apparatus directly with the public alternating supply at 100 volts), but that the condenser was practically without influence. In the circulation experiments, 0.0192 gm. of nitric acid per hour was produced from half a liter of air, or about 14 per cent of the total amount possible. No effect was produced by substituting alkali hydroxid for water in the apparatus. Neither ammonia nor nitrous acid was produced. In the constant volume experiments, whether the gases were mixed in the proportions $N_2:O_5$ or there was excess of nitrogen, reaction occurred to the (practically) complete disappearance of oxygen; and here, also, no other reaction than the direct formation of nitric acid took place. In these experiments, measurements of pressure and time showed an acceleration of the reaction after the beginning, followed by a gradual retardation as the pressure (and hence the concentrations of the reacting gases) diminished, so that the theoretical completion of the reaction would occur only after infinite time. It is to be remembered that the reactions here concerned—

$$N_2+O_5+H_2O+Aq=2HNO_3 \text{ dilute; or,}$$
$$N_2+O_5+H_2O \text{ gas}=2HNO_3 \text{ gas;}$$

are exothermic, and differ in this from the formation in the arc of nitric oxid or nitrogen peroxid from their elements."

The industrial utilization of the nitrogen of the air, C. FUSCHINI (*Rivista, 4. ser., 12* (*1906*), *No. 19, pp. 435–441*).—This is a review of a report by O. N. Witt which has already been noted (E. S. R., 17, p. 746).

The electrical production of nitric acid from the elements of the air, L. GRANDEAU (*Ann. Sci. Agron., 3. ser., 1 (1906), No. 1, pp. 1–60, figs. 29*).—The works, apparatus, and methods employed at Notodden, Norway, are quite fully described. This article is also published as a separate.

Oxidation of nitrogen by silent discharges in atmospheric air, E. WARBURG and G. LEITHÄUSER (*Ann. Phys., 4. ser., 20 (1906), No. 4, pp. 743–750; abs. in Amer. Jour. Sci., 4. ser., 22 (1906), No. 131, p. 462*).—The authors report a series of experiments from which they conclude that "(1) nitrose gases in the presence of ozone are easily absorbed by dilute soda lye; (2) with silent brush discharges from the positive terminal sphere in atmospheric air, at the room temperature, independently of the moisture of the air, 10 liters of NO is oxidized by an ampere hour; (3) the oxidized quantity of nitrogen mixture increases with increasing temperature and then decreases with the formation of the ozone; (4) a quantity of N_2O_4, indicating 1 cc. NO in 1,500 cc. lessens the formation of ozone when the silent discharge occurs in atmospheric air."

Nitric acid and other spark reactions (*Jahrb. Elektrochem., 11 (1904), pp. 610–615*).—The literature especially of investigations relating to the preparation of nitric acid from the atmosphere is reviewed.

A domestic supply of nitrogen, N. CARO (*Ztschr. Angew. Chem., 19 (1906), No. 37, pp. 1569–1581, figs. 5*).—Statistics of production and consumption of nitrogen compounds are given, and the apparatus and processes used and the commercial success attained in the manufacture of nitrogen compounds, especially calcium cyanamid, potassium cyanid, and nitrates, are described. It is stated that the cost of production in these methods is still too high to enable the products to compete successfully with the natural supplies except possibly in special cases of unusually cheap power, etc.

Nitrogen lime, its use and action (*Deut. Landw. Presse, 33 (1906), No. 48, pp. 405, 406; Landw. Wchnbl. Schles.-Holst., 56 (1906), No. 40, pp. 602, 603*).—A brochure on this subject by Münzinger of the Darmstadt experiment station is briefly reviewed.

Apparatus for the preparation of lime nitrogen and ammonium sulphate according to the methods of the Cyanid Company of Berlin (*Deut. Landw. Presse, 33 (1906), Nos. 76, p. 606, figs. 4; 79, p. 631, fig. 1*).—The construction and operation of the furnaces and other apparatus used in preparing these compounds by the Frank and Caro and Siemens processes are described and illustrated.

The making of sulphate of ammonia (*Amer. Fert., 25 (1906), No. 4, pp. 5–10, figs. 3*).—This article discusses briefly the value of ammonia in agriculture and describes the methods used in preparing ammonium sulphate by the destructive distillation of coal.

Treatment of vinasse and molasses for recovery of nitrogenous matter after removal of potash, VASSEUX (*Bul. Assoc. Chim. Sucr. et Distill., 23 (1906), No. 12, pp. 1381, 1382; abs. in Jour. Soc. Chem. Indus., 25 (1906), No. 16, p. 823*).—The author points out that while the nitrogenous matter contained in molasses is more valuable than the potassium salts present, the former is generally lost by incineration during the process of working up the saline matter. He proposes the following method for its recovery: The vinasse is concentrated and treated with sulphuric acid, thus converting the potash into sulphate, which crystallizes out. The mother liquors are then evaporated to dryness in an apparatus of special construction, yielding a residue containing from 5 to 7 per cent of nitrogen and 6 to 7 per cent of potash.

On the practical value of lime nitrogen as a fertilizer, W. VON KNIERIM

(*Rigasche Indus. Ztg., 1906, p. 204; abs. in Chem. Ztg., 30 (1906), No. 88, Repert. No. 41, p. 370*).—The author reviews other investigations on this subject and reports experiments during 1905 with oats to test the fertilizing value of lime nitrogen as compared with nitrate of soda. The material was applied 10 days before seeding and cultivated in to a depth of 3 to 5 in. The lime nitrogen gave somewhat better results than nitrate of soda, both as regards yield of grain and of straw.

Preliminary experiments with a cyanamid compound as a nitrogenous fertilizer, F. T. Shutt and H. W. Charlton (*Proc. and Trans. Roy. Soc. Canada, 2. ser., 11 (1905–6), Sec. III; Chem. News, 94 (1906), No. 2444, pp. 150–152*).—Experiments to determine the effect of calcium and potassium cyanamido-carboxylate on the germination or vitality of seed wheat and peas, and the rate at which these compounds are nitrified when present in the soil in various proportions, are reported.

The results in the first case led to the conclusion "that the presence of the cyanamid compounds in amounts equivalent to 5 mg. or less of nitrogen per 100 gm. of soil would not prove injurious to the germination of seed. Toxic effects were markedly noticeable, however, with amounts between 10 and 20 mg. per 100 gm. soil, while still larger quantities proved fatal. The potassium compound appears to be more injurious in its action on the life of the seed and of the young plants than the calcium salt."

In the second case the results indicate "that with the increase in the amount of the cyanamid compound there is a concomitant decrease in the rate of nitrification. This is probably due, as already indicated, to a toxic action upon the nitrifying organisms by the cyanamid compound, which action would naturally be increased the larger the application. On the other hand, it may in part be due to denitrifying changes leading to the loss of nitrogen in the free state.

"The conversion of the nitrogen of the cyanamid into available forms is, most probably, under favorable conditions, continuous, though not uniformly so. The first stage may be considered possibly as purely chemical, since water at ordinary temperatures converts the nitrogen of cyanamid into ammonia. The further changes being brought about through the agency of living organisms are necessarily slower and will be regulated by many factors, prominent among which, as we have observed, is the proportion of the cyanamid compound present in the soil."

Fertilizer experiments in 1905 with calcium cyanamid in comparison with other nitrogenous fertilizers and liquid manure, G. Caruso (*Atti R. Accad. Econ. Agr. Georg. Firenze, 5. ser., 3 (1906), No. 2, pp. 228–238*).—Comparative tests of calcium cyanamid, ammonium sulphate, sodium nitrate, and liquid manure on corn and beans grown on coast lands which were well provided with fertilizing constituents are reported. Notwithstanding the fact that the soil was in a good state of fertility, all of the nitrogenous fertilizers produced an increase in crop. The order of efficiency was calcium cyanamid, ammonium sulphate, sodium nitrate, and liquid manure. The calcium cyanamid increased not only the yield of grain, but also its weight per bushel. The high efficiency of the calcium cyanamid is attributed partly to the lime which it contains, supplying a deficiency in the soil, and to the more lasting and uniform effect of the nitrogen it contains. The calcium cyanamid used in these experiments furnished nitrogen at one-fifth less cost than sodium nitrate.

The decomposition of calcium cyanamid when used as a medium for bacteria, R. Perotti (*Arch. Farmacol. Sper. e Sci. Aff., 5 (1906), No. 9, pp.*

385–394, pl. 1).—In previous experiments the author has shown that in certain concentrations calcium cyanamid has a decided antiseptic action. In lower concentrations, however, a considerable growth of bacterial flora takes place.

In the experiments here reported, it was shown that by the action of microorganisms ammonia was formed from the calcium cyanamid, thus agreeing in general with the results obtained by Löhnis (E. S. R., 17, p. 345). It is not considered, however, that this action is a result of a specific function possessed by a determinate form, but is a part of the great process of ammonia production which goes on in soils as a result of the action of innumerable forms of microorganisms. The author's results differ from those of Löhnis in that he was unable to obtain the complete decomposition of the calcium cyanamid reported by Löhnis in some cases. This discrepancy is thought to have been due to the fact that Löhnis used a method of preparing his liquid media (sterilization by heating in a current of steam) which probably resulted in the formation of dicyandiamid, which very likely is more readily converted into ammonia than the calcium cyanamid. This is a point which demands further investigation.

Experiments on the fate of the nitrogen of green manures in light sandy soils, VON SEELHORST (*Mitt. Deut. Landw. Gesell., 21 (1906), Nos. 28, pp. 289–293; 29, pp. 295–299*).—The details of experiments on sand in large tanks to determine the balance of nitrogen with different methods of green manuring for various crops are reported. The results, while not considered conclusive, indicate that the greater part of the rather large amount of the nitrogen of green manures which is not utilized by crops on sandy soils is carried away in the drainage, while a smaller proportion is lost by denitrification, especially on soils dried out by growth of a crop of cereals.

Field experiments at Jarville with phosphatic and nitrogenous fertilizers, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 12 (1906), No. 37, pp. 325–327*).—The results of a series of experiments are briefly summarized. These show that bicalcium and monocalcium phosphate gave practically the same results and were about equally profitable. Fine ground mineral phosphates gave much lower yields. Nitrogenous fertilizers in general were about four times as effective in increasing the yield as potassic and phosphatic fertilizers.

Norwegian nitrate and the culture of corn, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 12 (1906), No. 38, pp. 360, 361*).—A comparison of normal and basic nitrate of lime, nitrate of soda, and nitrite of lime, each applied to corn at a rate of 45 kg. of nitrogen per hectare (40 lbs. per acre) is reported, the results showing that the nitrates of lime were about as efficient as the nitrate of soda and the nitrite of lime somewhat more efficient.

Nitrite and nitrate as a top-dressing for corn, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 12 (1906), No. 40, pp. 421, 422*).—This is a brief summary of experiments during 1906 at Parc des Princes, in which nitrite from Notodden, Norway, and nitrates of soda and of lime were compared. The results show that nitrites applied broadcast at the time of seeding were not injurious and had a fertilizing value for corn equal or superior to nitrate of soda.

A further contribution to the question of the influence of fertilizing with straw on the yield, C. VON SEELHORST (*Jour. Landw., 54 (1906), No. 3, pp. 283–300; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 528, II, p. 702*).—Further tank and pot experiments on this subject are reported (see also E. S. R., 16, p. 35) which were undertaken to study the effect of the depth of application of straw and strawy manure and of variations in aeration, moisture, and character of the soil on the loss of nitrogen. The experiments were made in tanks $1\frac{1}{3}$ meters deep and 1 meter in diameter sunk in the earth, and in ordinary pots.

The results show that straw and strawy manure in absence of nitrate of soda caused a reduction of yield dependent upon the character of the soil, being quite marked on poor soils and very small on more fertile soils. The loss is generally confined to the first year, except in case of poor, sandy soils. With loam soils treated with nitrate of soda there is a slight increase the second and third years after application of straw.

The results of several years' field experiments with fertilizers, TACKE (*Jahrb. Deut. Landw. Gesell., 20 (1905), pp. 36–46, fig. 1*).—Various practical conclusions which, however, are applicable mainly to German conditions, are drawn from the results summarized.

The use of fertilizers in extensive culture with reference to geological formation and soil analysis, H. BOCK ET AL. (*Jahrb. Deut. Landw. Gesell., 20 (1905), pp. 46–55*).—Various general views on this subject are presented in their application to German conditions.

On the relative value of different phosphates, D. N. PRIANISHNIKOV (*Landw. Vers. Stat., 65 (1906), No. 1–2, pp. 23–54, pls. 9, fig. 1; abs. in Chem. Abs., 1 (1907), No. 1, p. 79*).—In continuation of previous experiments (E. S. R., 13, p. 934) sand culture tests were made of leached ashes, bone meal, Thomas slag, phosphorite, and superphosphate on tobacco, buckwheat, oats, barley, millet, lupines, Robinia, peas, mustard, and sugar beets. The tests were designed to determine not only the relative fertilizing effect of these phosphates, but also the factors affecting their assimilability.

The results show in general that the phosphoric acid of leached ashes, especially those of straw, is readily assimilable; the phosphoric acid of bone meal showed a relatively good assimilability, the yields with this form of phosphoric acid being, as a rule, not lower than 50 to 60 per cent of those with soluble phosphoric acid. Poorer results were obtained in presence of calcium carbonate and ferric hydrate in the soil. The influence of the latter was, however, overcome when ammonium salts were also applied. The tests of raw phosphates indicated that their assimilability was more influenced by the character of the crop than by the properties of the phosphate. In soil cultures acidity is of course a determining factor.

The assimilation of phosphates is greatly modified by the presence of ammonium salts, so much so that even the most insoluble phosphates are rendered available to all plants. This is ascribed to the physiological acidity of such salts as ammonium sulphate and ammonium chlorid. When experiments are made with soils this action is modified by nitrification, which, for example, makes two free acids out of a neutral salt like ammonium sulphate. The action is further modified by the amount of basic substances present in the soil.

On the stability of Thomas-phosphate-ammonium-lime, M. SCHMOEGER (*Ztschr. Angew. Chem., 19 (1906), No. 40, p. 1681*).—This is a note on an article presented at the recent meeting of the German Association of Naturalists and Physicians, in which experiments are reported showing that there is a large loss of nitrogen when this mixture is allowed to stand for some time.

The behavior of bone and mineral superphosphate in soils and the modifications which they undergo, C. MONTANARI (*Staz. Sper. Agr. Ital., 39 (1906), No. 4, pp. 323–339*).—Other investigations on this subject are reviewed and experiments by the author on 8 soils of different kinds are reported.

Basic slag (*Mark Lane Express, 95 (1906), No. 3912, pp. 299, 300, figs. 2*).—A summary is given of information relating to the history, manufacture, qualities, and use of this material.

A field experiment to test the merits of phosphate, potash, and nitrogen

on a fine sandy loam of peculiar character, E. HERSEY (*Bul. Bussey Inst., 3 (1906), pt. 5, pp. 113–119, dgms. 2*).—Comparative tests of various fertilizing materials on corn grown on a fine sandy loam which was well supplied with capillary water are reported, showing a marked superiority of the bone over all other fertilizing materials.

The use of leucitic rocks as fertilizer, E. MONACO (*Staz. Sper. Agr. Ital., 36 (1903), No. 7, pp. 577–583; 37 (1904), No. 11–12, pp. 1031–1034; 39 (1906), No. 4, pp. 340–349*).—Studies of the amount of potash, lime, etc., dissolved by water and other solvents from various leucitic rocks, soils, etc., are reported.

Process for the utilization of potash minerals, insoluble and soluble with difficulty, for fertilizing purposes, C. PLOCK and H. MEHNER (*Jour. Soc. Chem. Indus., 25 (1906), No. 18, p. 898*).—Brief reference is made to a German patent of a process providing for the use of such minerals, especially "phonolith" waste, in place of sand as an addition to molten Thomas slag.

Potash salts (*Mark Lane Express, 95 (1906), No. 3915, pp. 383, 384, figs. 2*).—Information regarding the mining and use of potash salts in agriculture is summarized.

The peat and marl deposits of the Rederang and Moorsee basins, U. STEUSLOFF (*Arch. Ver. Freunde Naturgesch. Mecklenb., 59 (1905), 2. Abt., pp. 147–210, pl. 1*).—The extent and character of these deposits are described in some detail.

Origin, composition, and utility of fertilizing materials, R. J. DAVIDSON and W. B. ELLETT (*Virginia Sta. Bul. 163, pp. 48*).—This is a compilation of information on the composition, value, and use of farm manures and fertilizers, including also a discussion of home mixing and formulas for fertilizer mixtures for various crops.

Analyses of commercial fertilizers and Paris green, J. E. HALLIGAN (*Louisiana Stas. Bul. 87, pp. 50*).—This bulletin gives the results of analyses of 2,508 samples of fertilizing materials and 73 samples of Paris green inspected during the season of 1906. The results of the inspection of fertilizers show a general tendency toward excess of phosphoric acid and deficiency of nitrogen in mixed goods, as well as in tankage. The samples of cotton-seed meal examined were very variable in composition. The acid phosphates and bone meals as a rule exceeded the guaranties.

AGRICULTURAL BOTANY.

The sexuality of cotton, W. L. BALLS (*Yearbook Khediv. Agr. Soc. Cairo, 1905, pp. 197–222, pls. 9*).—Investigations have been begun by the author on heredity in cotton. The present paper includes the history of the cotton flower and the early stages of the embryo, while changes in the seed and development and maturation of the fiber will be discussed in a subsequent publication.

The cytology of the sex cells is described at considerable length, and a brief account is given of the development of the cotton fiber. This begins before fertilization is accomplished, but whether it is entirely independent of pollination or not has not been definitely determined. Contrary to previous reports, the development of the fiber is not from subepidermal cells of the outer integument, as is usually stated, but by simple linear extension of the epidermal cells, the cotton fiber thus being a simple epidermal hair.

The mechanism of carbon assimilation in green plants, F. L. USHER and J. H. PRIESTLEY (*Proc. Roy. Soc. [London], Ser. B, 77 (1906), No. B 518, pp. 369–376; 78 (1906), No. B 526, pp. 318–327*).—A series of experiments has been carried on to determine the nature of the first stages in the assimilation of carbon from carbon dioxid by green plants. It has been shown that carbon

dioxid may be decomposed by uranium acetate, the decomposition resembling that which takes place within the plant. This is accompanied by the formation of formaldehyde, which is rapidly converted into some physiological inert substance, and peroxid, which is decomposed with the evolution of gaseous oxygen.

Experiments on the mechanism of the evolution of oxygen from the green plant suggest the presence of a catalyst, probably an enzym, and this enzym has been found in the foliage leaves of plants representing 46 natural orders of vascular cryptograms and phanerogams. It also occurs in etiolated leaves and potato tubers, appearing to be associated with amyloplasts, whether possessing chlorophyll or not.

Experiments with Spirogyra have shown that a starchless filament will contain starch within 3 minutes after exposure to light, and it is believed that starch is not elaborated within the cell until the supply of that nutrient is in excess of the cell's requirements. It would therefore seem that there must be some arrangement for the rapid removal of formaldehyde, and for this reason it is useless to attempt to find formaldehyde in healthy assimilating leaves.

Summarizing their conclusions, the authors state that photolysis of carbon dioxid may take place outside the plant in the absence of chlorophyll, providing one of the products is removed. The normal products of photolysis are hydrogen peroxid and formaldehyde, though under certain conditions formic acid may be formed. In the plant the decomposition of the hydrogen peroxid is provided for by a catalytic enzym of general occurrence, and the condensation of the formaldehyde is dependent on the healthy condition of the protoplasm.

In continuation of their investigations, reported in the second paper, the authors conclude that photolytic decomposition of aqueous carbon dioxid can take place in the presence of chlorophyll independently of vital or enzym activity, provided the necessary physical and chemical conditions are strictly adhered to. The products of the decomposition are formaldehyde and hydrogen peroxid, formic acid being an intermediate product. It is possible to reconstruct the process of photosynthesis outside the green plant, so far as the production of formaldehyde and oxygen is concerned, by introducing a suitable catalytic enzym into the system, and for the production of oxygen and starch by introducing, in addition to the enzym, certain kinds of nonchlorophyll-bearing living protoplasm.

There is direct experimental proof that formic acid is a product of the photolytic decomposition of carbon dioxid in the presence of an inorganic uranium salt. Formaldehyde has not been isolated and identified in the case of decomposition by the inorganic uranium salt, but a study of the reactions favors the view that it is formed as a transitory intermediate product.

Variations in chlorophyll assimilation under the influence of light and temperature, W. LUBIMENKO (*Compt. Rend. Acad. Sci. [Paris], 143 (1906), No. 17, pp. 609–611*).—In continuation of previous investigations on the sensitiveness of the chlorophyll of plants tolerant and intolerant to shade (E. S. R., 17, p. 651), the author reports briefly on experiments to determine the effect of light and heat on the decomposition of carbon dioxid by plants.

In his experiments leaves of a number of species of tolerant and intolerant trees were exposed for 15 minutes to full sunlight, the rays falling upon the leaves parallel to their surface and at 45° and 90° angles of inclination. The temperatures were held for different lots at 20°, 25°, 30°, 35°, and 38° C. and the carbon dioxid decomposition determined in each case. Among the plants studied were fir, spruce, yew, and linden as tolerant species, and pine, black locust, and white birch as intolerant to shade.

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When the minimum of illumination, parallel rays, was studied it was found that the carbon dioxid assimilation increased with the increase in temperature. Where the illumination was at 45°, which corresponds with average illumination, the increase was regular and the temperature rose until an optimum was reached, after which the decomposition fell off more rapidly for the tolerant than for the intolerant species. Similar results were obtained when the leaves were illuminated vertically, the decrease beyond the optimum falling more rapidly than when less illuminated.

Summarizing his investigations, the author claims that under the conditions of his experiments heat and light facilitate carbon dioxid decomposition, that there is an optimum for each beyond which the assimilative energy diminishes, and that the diminution in assimilation of carbon dioxid takes place more rapidly with tolerant species than with those intolerant to shade.

Temperature and toxic action, C. Brooks (*Bot. Gaz., 42 (1906), No. 5, pp. 359–375, dgms. 33*).—A report is given of experiments with a number of species of fungi to determine the modifying effect of temperature on the toxic properties of certain chemicals as shown by the effect of these substances on germination and growth. The chemicals tested were nitric acid, sulphuric acid, and a solution of copper sulphate, and the fungi employed were *Botrytis vulgaris*, *Monilia fructigena*, *Sterigmatocystis nigra*, *Mucor mucedo*, and *Penicillium glaucum*. The first two of these fungi are usually considered parasitic and have a relatively low optimum temperature, while the last three are saprophytes and grow well at temperatures considerably above the optimum for the first two.

It was found that in most cases the deleterious action of the toxic agent increased rapidly with the rise in temperature, although there were marked differences in the various fungi noted. There was a decided drop in the germination curves for Botrytis and Monilia between 5° and 10°. With Penicillium the fall came either between 10° and 15° or between 15° and 20°, while with Mucor and Sterigmatocystis the downward curves began at 15° or 20°. There was also found a remarkable agreement in the minimum temperature for the germination of a particular fungus under certain conditions and the location of the fall in the germination curve. In all cases the injurious effects were least at the optimum temperature for the germination of the fungus, as shown from check cultures to determine the rate of germination and development.

Taking the total growth as a standard, the injurious effects of the toxic agents decreased with the rise of temperature. This decrease is considered as the result of approaching the optimum for the fungus rather than a mere temperature effect, and the effects produced by the three chemicals were widely different. The injury resulting from the copper sulphate solutions was not as great, comparatively, at 15° as at 20°, while this was true of neither of the acids. Sulphuric acid checked growth at the lower temperatures, but in no case served as a strong stimulating agent. Nitric acid gave similar injurious effects, but at the higher temperatures served as a remarkable stimulus.

Investigations on the effect of soil sterilization on the development of plants, C. Schulze (*Landw. Vers. Stat., 65 (1906), No. 1–2, pp. 137–147, pls. 4*).—In connection with previous studies (E. S. R., 13, p. 841) some effects of soil sterilization on the growth of plants were observed, and the author has since carried on experiments to determine the relation between soil sterilization and development of plants.

Pot experiments with field, meadow, and garden soils were made, the plants used being oats, mustard, peas, buckwheat, and grasses. To each pot a nitrogen-free chemical fertilizer was added, which contained phosphoric acid, dibasic calcium phosphate, dibasic potassium phosphate, and magnesium sulphate. One pot of each series was untreated, one sterilized for an hour at

125° C. before fertilizing with the above-described mixture, a third was sterilized at 125° C. after adding the fertilizer, and a fourth was sterilized at 100° C. for 18 hours.

During sterilization there was found to be a formation of more or less injurious decomposition products and also a release of otherwise nonavailable nitrogen. The decomposition products acted upon the different species of plants according to their sensitiveness, and the addition of lime counteracted their injurious effects. In general, sterilization seemed to retard growth for a time, but later the plants became more vigorous in the sterilized pots, often exceeding in total growth those in the untreated pots. In every case the proportion of nitrogen to total plant production was increased in the sterilized pots. Except in those pots in which mustard and peas were grown in sterilized meadow soil, there was an increase in the total plant product, which was attributed to sterilization.

Studies on the lignin and cellulose of wood, P. SPAULDING (*Mo. Bot. Gard. Ann. Rpt., 17 (1906), pp. 41–58, pls. 2*).—A previous author has shown by microchemical methods that cellulose occurs as a distinct lining layer in the walls of wood fibers of perfectly healthy trees, and he claims that a gelatinous thickening layer which reacts to the various color tests for cellulose occurs very commonly in the fiber walls of the xylem as a normal condition in a great number of healthy trees, in all localities and situations. The presence of this unlignified layer in the wood fibers he thinks probably represents a stage of arrested development and is not to be attributed to the action of fungi. Furthermore, he claims that delignification can not be attributed to an enzym secreted by fungi.

These statements the author has investigated to determine the prevalence of cellulose in the trees of America, to test the methods of the previous author's investigations, and to determine to some extent the action of fungi on wood. Two sets of experiments were carried on. The first, which is of a preliminary nature, included but a few species of wood, while in the second about 40 of the more common timber trees were tested.

The tests for cellulose showed that it was fairly abundant in a number of species but in others occurred only in very small quantities or could not be detected at all. In species of Populus and Salix it was found to form a thick distinct inner layer of the fiber wall which seemed to be somewhat loosely attached to the secondary lignified one. Cellulose was never found in the cells of the oldest wood of the annual rings, but was always situated in the more open early wood.

In testing the methods of the previous investigator it was found that none of the woods were delignified by boiling in the time stated. Apparently the woods used in these experiments were more thoroughly lignified or else their lignin was held more firmly in combination.

The author thinks there is evidence to show the incorrectness of the claim that cellulose is due to arrested development or is present in the form of reserve material. In his studies he finds corroborative evidence of the delignification by means of fungi.

In conclusion, the author states that there can be no doubt that enzyms or some substance exhibiting the characteristics of enzyms have been proved to exist in some of the fungi and indeed in some of the wood-rotting ones. The disappearance of starch in the early stages of attack of some wood-rotting fungi seems to be generally attributed to the secretion of diastase by the fungi, and there appears to be no reason why the disappearance of lignin from the fiber walls, leaving cellulose in the last stages of decay, should be attributed to any cause other than the secretion of a delignifying enzym.

Cyanogenesis in plants, J. W. LEATHER (*Agr. Jour. India, 1 (1906), No. 3, pp. 220–225*).—After briefly noting the occurrence and distribution of cyanogenetic glucosids in a number of species of plants, the author describes his investigations with 3 species of plants of economic importance.

Analyses are reported of samples of sorghum that were taken as a part of a lot that had been held responsible for poisoning a number of cattle. The fodder when received was partially air-dried and found to yield 1.28 grains prussic acid per pound of green fodder. The crop had been grown under irrigation and was in flower when cut. Other investigations showed a wide variation in the amount of prussic acid, depending apparently upon the variety and the stage of maturity, the content decreasing as maturity was approached. In a sample of sorghum that gave 0.17 grain prussic acid per pound in the air-dried material it was found upon analysis that the leaves contained 2.5 grains, the stalks 1.1 grains, and the flowers 0.25 grain. Sun drying seemed to have no effect on the glucosid.

Experiments with cassava showed that no variety contained prussic acid as such, but all contained a cyanogenetic glucosid, and associated with it was an enzym capable of splitting up the glucosid with the formation of prussic acid. The common classification of bitter and sweet cassava is based upon the amount of glucosid present.

The third plant investigated was flax, the feeding of which was held responsible for the death of more than 50 head of cattle. Specimens of the suspected forage upon analysis yielded 1.4 grains prussic acid per pound of the plant.

In addition to these plants the author reports having obtained prussic acid from beans (*Phaseolus lunatus*) and *Dolichos lablab* by simply allowing the crushed seeds to remain in cold water for a few hours. In the case of seeds of this kind their poisonous properties may be destroyed by boiling them in water.

Cyanogenic glucosids of plants and the utilization of reserve nitrogen, M. SOAVE (*Staz. Sper. Agr. Ital., 39 (1906), No. 5, pp. 428–437*).—Studies are reported of the germination of the seed of the Japanese medlar (*Mespilus japonica*), in which attempts were made to ascertain the amount of free hydrocyanic acid and the rôle of glucosids occurring in the seed.

It was found that hydrocyanic acid was not present in the seeds of the Japanese medlar, or in such minute quantities as to be shown only by the most delicate tests under favorable conditions. Amygdalin was present, however, often to the extent of 6.89 per cent of the total nitrogen of the seed. With the germination of the seed free hydrocyanic acid appeared, and at some stages of the development was found to amount to as much as 1.93 per cent of the total nitrogen. At the same time the amygdalin and other glucosids increased to 7.22 per cent of the total nitrogen. The nitrogen in the hydrocyanic acid and in the amygdalin was found to amount to as much as 9.15 per cent of the total nitrogen, indicating that the remaining nitrogen in part at least had assumed a glucosidal form. This the author has shown takes place in sweet and bitter almonds, and he believes it will be found true also in experiments with seeds containing cyanogenic glucosids other than amygdalin.

Hydrocyanic acid, which is a widely distributed principle in plants, appears to be the first nitrogenous compound formed by plants and serves as the beginning of the proteid substances elaborated later.

The occurrence of prussic acid and its derivatives in plants, T. A. HENRY (*Sci. Prog. Twentieth Cent., 1 (1906), No. 1, pp. 39–50*).—A summary is given of the present information relative to the occurrence of prussic acid in plants, the author stating that it has been found in over 100 species of plants representing 22 different orders. The occurrence of prussic acid in plants is in the form of cyanogenetic glucosids, a number of which are described. Associated

with the glucosids are enzyms which act upon the glucosids, liberating prussic acid.

Attention is called to the fact that little is known regarding the method by which prussic acid is produced by plants, although it has been suggested that it is formed by the reduction of nitrates by formaldehyde. The need of further investigations on this subject is pointed out.

A study on leguminous tubercles, J. Štefan (*Centbl. Bakt.* [etc.], *2. Abt., 16 (1906), No. 4–6, pp. 131–149, pls. 2, figs. 2*).—Summarizing his investigations, the author states that the micro-organisms causing root tubercles on leguminous plants live for a time at the expense of the host plant, after which they become degenerate pathological forms. This degeneration is said to be due to the accumulation of injurious substances secreted by the organisms, and extends to the cells of the host plant, ultimately involving the entire tubercle. The transfer of the assimilable nitrogen from the organisms to the host plants follows the ordinary physical laws of osmosis. On the whole the host plant gains by the symbiosis as it receives all the albuminoid substances produced by the micro-organisms and uses them in building up its tissues.

The tubercles which appear in the axils of small rootlets branching from the larger ones really have their origin from the larger rootlets. In some perennial leguminous plants round degenerate tubercles are often found. The author's investigations indicate that in some plants, such as Galega, the tubercles serve as true storage organs.

The infection strands of Phaseolus were found to not retain their vitality very long, but they are usually as abundant as in the majority of legumes. In the clovers they are especially persistent. In nearly all kinds of infection strands there are to be found numerous sudden swellings which contain the so-called bacteroids. These bacteroids are involution forms which while young are thin-walled and capable of rapid division, but when older become swollen and finally degenerate. The bacteroids seem to be able to break through the infection strands at any point.

In considering the classification of *Bacillus radicicola*, the author thinks it should be placed near the Myxobacteriaceæ.

The influence of certain oligodynamic actions on the development and activity of Bacterium radicicola, R. Perotti (*Separate from Ann. Bot.* [*Rome*], *5 (1906), No. 1, pp. 87–92*).—A series of pot experiments with beans, alfalfa, and red clover was conducted in which, in addition to equal amounts of fertilizing constituents, various amounts of a number of mineral compounds were added. Solutions varying from 1 part in 50,000 to 1 part in 2,500 of the sulphates of potassium, chromium, manganese, iron, cobalt, nickel, and copper, and of the chlorids of barium and mercury were added to the cultures and the effects on growth noted. All the cultures showed a stimulation due to the oligodynamic action of the solutions. In general, there was an increase in growth, dry weight, number and weight of tubercles, etc., corresponding to the increase in the atomic weight of the mineral up to a certain point, after which there was a falling off in a corresponding ratio.

FIELD CROPS.

Guide to plant culture, M. Fischer (*Leitfaden der Pflanzenbaulehre.—Stuttgart: E. Ulmer, 1906, pp. 231, figs. 113*).—This book is intended for the practical farmer and for use in agricultural schools. It is divided into 3 parts, the first treating of plant culture in general and including plant nutrition, soil, and climate; the second part being devoted to special plant culture, with discussions on the growth of cereals, leguminous crops, forage plants, hoed crops, and industrial crops; and the third part discussing plant breeding in its general

aspect as well as with reference to breeding particular crops. A bibliography is presented.

Report of school of agriculture farm, 1905, W. CARTWRIGHT (*Yearbook Khedir. Agr. Soc. Cairo, 1905, pp. 245–254, chart 1*).—In an outline of the general work conducted at the farm during the year a fertilizer experiment with corn is described. The crop was grown after barley and after berseem. Nitrate of soda was applied at the rate of 104 kg. and ammonium sulphate at the rate of 80 kg. per feddan (1.08 acres). The quantities of nitrogen furnished by these applications were equal to the amount applied in a 10-ton dressing of manure. The gain from the use of nitrate and manure was insufficient to pay for the expense incurred, but the ammonium sulphate gave a profit which is considered due to its having been more fully utilized than the nitrate. The increase produced by the sulphate after berseem was far less than after barley, which is taken to indicate that the optimum application on the berseem field had been passed.

Alfalfa as a forage crop for Pennsylvania, G. C. WATSON (*Pennsylvania Sta. Bul. 79, pp. 12*).—General notes on the culture of alfalfa in Pennsylvania, together with reports of experiments conducted on the station farm and in Lancaster County of the State.

It was found in these experiments that alfalfa thrived in a compact, gravelly soil of good drainage quite as well as in a loose loam. In fertilizer tests the crop made the best growth where a heavy application of phosphoric acid and potash had been made. The use of 5 tons of barnyard manure per acre gave better results than the phosphoric acid and potash contained in 500 lbs. of a good brand of commercial fertilizer. Turkestan alfalfa did not give as good results as common alfalfa.

It was also found that fall-sown alfalfa on dry land withstands the severe winters of this climate perfectly and better than the common red clover. In several instances, however, the alfalfa withstood the first winter, but was completely winter killed during the second. The larger growth seemed to give no assurance of success on wet soil. It was observed that where the plants made a strong and vigorous start the roots were provided with nodules, while where plants were weak and slow in starting, only a few of the plants were so provided. Lime was in no case applied to advantage.

The A B C of corn culture, P. G. HOLDEN (*Springfield, O.: Simmons Pub. Co., 1906, pp. 92, figs. 84*).—This is a popular treatise on corn culture, discussing briefly soil preparation, cultivation, preparation of seed corn, combating corn pests, harvesting and storing seed, selection and judging of corn, and the importance of the crop. Descriptions are also given of a number of standard varieties.

Score card for dent corn (*Ohio Sta. Bul. 61, pp. 4*).—The score card presented has been adopted as the official score card of the Ohio Experiment Station and the department of agronomy of the State University. The different points are briefly explained.

Cotton, its production, consumption, and economic importance, R. PUPIN (*Le Coton, sa Production, sa Consommation, son Rôle Économique. Paris: Felix Alcan, 1906, pp. 84*).—The history of cotton is briefly reviewed, and its culture, commerce, and consumption, together with its influence as an economic factor discussed, and statistics bearing on different phases of production and trade are presented. The processes of spinning cotton and manufacturing and dyeing cotton fabrics are also described.

The selection of cotton seed, G. P. FOADEN (*Yearbook Khedir. Agr. Soc. Cairo, 1905, pp. 119–141, pl. 1, figs. 3*).—The necessity for the selection of cotton seed is discussed, the method used in Egypt described, and plans for a more systematic selection outlined.

It is stated that small cultivators use seed of common quality, regardless of origin and purity, and that to overcome this difficulty the Khedivial Agricultural Society, in connection with the agricultural bank, distributes annually the best seed obtainable at cost price, the value of which is collected at the end of the following cotton season. This system does nothing to actually improve the seed and for this reason the country is in urgent need of a more effective method of selection and distribution. A description of cotton seed selection, as given in the Yearbook of this Department for 1902, is reproduced. It is pointed out that a variety of cotton known as Hindi is found mixed with the improved varieties, especially Afifi, and that the elimination of this sort from the better kinds is one of the principal problems connected with seed selection.

Experiments with oats, J. F. Duggar (*Alabama College Sta. Bul. 137, pp. 59–94, figs. 8*).—This bulletin summarizes the experiments with oats conducted by the station over a period of 10 years.

In the tests of varieties the yields of Red Rust Proof, Appler, and Culberson, when sown in the fall, were practically equal. When sown after Christmas, Burt or May oats averaged 7 per cent less grain than Red Rust Proof. Turf, or Gray winter oats, sown in November produced only 59 per cent as much grain as Red Rust Proof sown at the same time. The order of ripening of the principal varieties sown in the fall was Burt, Red Rust Proof, and Turf. Red Rust Proof and its related varieties or strains, Appler and Culberson, are regarded as the best general-purpose varieties for that region. Burt oats was found chiefly valuable for its earliness, but it was apparently not as hardy as some of the other sorts.

The experiments conducted to determine methods for the reduction or prevention of winterkilling indicate that sowing in deep drills in October, growing a hardy variety, and using the land roller after the plants have been heaved and their roots exposed, are the most effective means. As compared with broadcasting, oats drilled in deep furrows about 2 ft. apart yielded 3.2 bu. per acre more when the deep furrows were only partly filled and 2.3 bu. more when the furrows were almost completely filled.

In general, fall sowing gave much better results than spring sowing. In 7 experiments made in 7 different years, Red Rust Proof sown in November gave an average of 11.3 bu. per acre more than when sown in February. From the results secured, it is advised to sow the seed in the fall in October and in the spring, during the first few days of February.

The results of the fertilizer tests show that nitrogenous fertilizers were more profitable than phosphate or potash on the sandy and loamy soils of the station, but they also indicate that on such soils the application of 100 lbs. of acid phosphate at the time of sowing may be recommended. Nitrogen in the form of nitrate of soda was more effective than in any other forms, and was also somewhat more effective in the form of cotton-seed meal than of cotton seed. It is advised to apply cotton seed or cotton-seed meal at the time of sowing and nitrate of soda as a top dressing in March after growth begins. Barnyard manure greatly increased the yield of oats and exerted some effect on the next crop. In one experiment 43.1 lbs. of nitrate of soda and 103 lbs. of acid phosphate were required to produce the same increase as 1 ton of fine, fresh, unbleached horse manure. In 13 experiments with nitrate of soda the yield and total profit increased with the quantity applied up to 200 lbs. per acre, but the cost of nitrate of soda required to produce one additional bushel of oats was 14.5 cts. from the use of 63 lbs. per acre, 17.7 cts. from the use of 100 lbs., and 21.1 cts. from the use of 200 lbs. Cowpeas, velvet beans, peanuts, or soy beans, whether the entire growth was plowed under the fertilizer or only the stubble, gave an increase in the succeeding oat crop of from 6.2 to 33.6 bu. per acre.

HORTICULTURE.

The relation of winter apples to hardiness of trees, W. T. MACOUN (*Canad. Hort., 29 (1906), No. 12, pp. 291, 292, fig. 1*).—As the result of 17 years' experimental tests with over 3,000 species and varieties of trees and shrubs other than cultivated fruits, the author states that a tree or shrub which will withstand a winter at Ottawa must be one that ripens its wood early. During the period of experimenting no apparent increase in hardiness has taken place in any of the individual specimens. "Plants which killed to the ground 17 years ago, kill to the ground still. Those which killed to the snow line, kill to the snow line still. Those which were killed back one-half or merely a few inches at the tip, do so still. Sometimes a tree will remain hardy for several years and then kill back near to the ground. It is possible that they are getting hardier very gradually, but if so this increasing hardiness is imperceptible so far." It has been noticed that following a season of strong growth in the trees winterkilling is more severe than when the growth is medium. Individual specimens of a species have been found hardier than others. This has been the case especially with *Catalpa bignonioides*.

Out of 700 named varieties of apples which have been tested at the station, the hardiest have come from the Northeastern and Northwestern States and Canada. The hardy varieties from Great Britain, France, and Germany are few as compared with those from the colder parts of Russia. Following the test winter of 1903–4, 164 varieties of apples were winterkilled. Of this number 130 were early winter and winter varieties and only 34 summer and autumn varieties. Summer and early-autumn varieties stop growth and ripen up their wood sooner in the season than the late-growing winter apples, and on this account are more able to withstand the severe winters. Fruit trees which originated in sections where the growing season is long usually winterkilled when grown in the short seasons of the north.

The larger part of the apples of merit which have been originated recently from seedlings in Canada are summer and autumn kinds. In order to secure new varieties which will mature in short seasons it is considered of vital importance that the ancestors of the seedlings be short season varieties. It is believed "that the basis for the production of the desired winter apple for the north should be a variety or varieties which have withstood test winters in the north and are also the latest keepers of such varieties."

A list is given of the varieties of apples which originated in the north and which stood the test winter of 1903–4. The list includes Canada Baldwin, Winter Rose, Calumet, Baxter, La Victoire, Stone, Scott Winter, and Milwaukee. From these varieties and other hardy seedlings growing at the station it is believed the prospect is bright for the origination of a hardy, long-keeping winter variety of good color and best dessert quality for the north.

Further experiments in the cool storage of fruit, G. QUINN (*Jour. Dept. Agr. So. Aust., 10 (1906), No. 2–3, pp. 75–78*).—Accounts are given in continuation of those previously noted (E. S. R., 17, p. 768) of storing plums, apples, and pears in cold storage for different lengths of time.

Burbank and Wickson plums were gathered when nearly matured, carefully wrapped in tissue paper and embedded in softwood wool in shallow trays, and then placed in cool storage for 8 weeks. The results were very unsatisfactory. The Burbank plums when withdrawn from storage, though not rotten, were shrunken in spots, the tissue being hard, brown, and tasteless, while the intervening spaces were practically normal in appearance. The Wickson fruits were practically flavorless and exhibited a brown discoloration around the pits. After a week

the flavor was very disagreeable, though not due to the ordinary processes of decay.

A large number of varieties of apples were successfully kept for 19 weeks in cold storage in a temperature ranging from 33 to 36° F. A number of pears kept for the same length of time gave less satisfactory results. It is believed, however, that with proper care in handling the fruit both apples and pears can be kept sufficiently well for shipment to English markets.

Fertilizing forced strawberries, VON BREHMER (*Gartenwelt, 11 (1906), No. 7, pp. 78, 79*).—An account is given of forcing strawberries in pots filled with the same kind of soil but differently fertilized. Chemical fertilizers were used and applied to the plants once a week in water solutions. There were 26 plants in 8-in. pots in each series.

The first ripe fruit in the control pots was secured May 28 and the total yield up to June 12 was 315 gm. When the plants were fertilized with a mixture of phosphoric acid and nitrate of potash the first ripe fruits were secured May 23 and the total yield was 2,050 gm. When to these fertilizers nitrate of lime was added the first ripe fruit was secured May 16 and the total yield was 3,950 gm. It is thus seen that by the use of a complete fertilizer plus nitrate of lime the yield was more than 10 times greater than where no fertilizer was used and the fruit ripened nearly 2 weeks earlier in the season.

Date varieties and date culture in Tunis, T. H. KEARNEY (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 92, pp. 112, pls. 10, figs. 52*).—Descriptions are given of 105 varieties of dates grown in Tunis, with a descriptive key to the characters of the fruit and an account of the characteristics of the principal date regions in Tunis and of the culture of the date palm. The number of varieties described in the bulletin is believed to be only about one-fourth of those in actual cultivation there but includes all of the more important varieties. The author personally visited the different regions described and succeeded in securing about 700 off-shoots representing 56 varieties, which were sent to the United States for trial. The descriptive key which has been worked out the author believes will become useful in identifying the Tunisian varieties.

Resistant vineyards. Grafting, planting, cultivation, F. T. BIOLETTI (*California Sta. Bul. 180, pp. 87–144, figs. 29*).—An extensive account is given of the details of grafting, planting, and nursery management for the establishment of resistant vineyards in California. Much of the matter contained has been given in earlier publications of the station (E. S. R., 12, p. 241).

Manurial experiments with cacao in Dominica (*West Indian Bul.*, 7 (*1906*), *No. 3, pp. 201–212*).—A summary is given of the fertilizer experiments carried on at the Dominica Botanic Station since 1900, some of the results of which have been previously noted (E. S. R., 17, p. 769). In addition the results secured on experimental plats in 7 country districts are noted.

At the botanic station the use of basic phosphate and potash without nitrogenous manure has not proved beneficial, but when dried blood has been added there has been a striking increase in the yield per care. A complete fertilizer therefore, is recommended. Even the application of dried blood alone has shown very beneficial results, there being a gain of 308 lbs. of wet cacao, or 4.4 lbs. per tree over the no-manure plat.

The most interesting results have been obtained on the plat mulched with grass and leaves, the sweepings of the lawns at the botanic station. At first the yields on this plat while in excess of those on the no-manure plat were considerably less than on the fertilized plats. During the past 3 years, however, the yields from this plat have greatly exceeded those of any other plat in the experiment. In 1905 the yield was 38.91 lbs. of wet cacao per tree against 22 lbs. from the no-manure plat, or a gain of 77 per cent. It is believed the plat has

been permanently improved by the application of the mulch, as the soil is more moist and dark in color and the trees have a better surface root development. The experiment is believed to show that a large increase in the yield of cacao can be obtained without the use of artificial manures and as mulching material is abundant it appears wasteful and unnecessary to purchase other manures. These results are believed to answer the question as to the best way to improve cacao cultivation in Dominica.

The results secured on the various fertilizer plats in the country districts indicate the phosphatic manures are quite generally beneficial.

Report of inspector of cocoanut plantations for the year 1905, L. C. Brown (*Agr. Bul. Straits and Fed. Malay States, 8 (1906), No. 8, pp. 265–269*).—The area under cocoanuts in the Federated Malay States in the year 1905 was estimated at 100,000 acres, on over half of which the trees were in bearing. An account is given of the acreage in each of the different districts and of the prevalent insects and diseases affecting the crop, with notes on cultivation, marketing, copra, oil production, etc.

FORESTRY.

Indian trees, D. Brandis (*London: Archibald Constable & Co., 1906, pp. XXXIV+767, figs. 201*).—This book is a systematic account of the trees, shrubs, woody climbers, bamboos, and palms indigenous or commonly cultivated in the British Indian Empire. It is designed for the use of foresters and others who wish to make themselves acquainted with Indian trees. The arrangement is botanical, and descriptions are given of over 4,400 species, 201 of which are illustrated. The author states that the book is not intended for botanists, but rather for foresters and practical men, and on this account species of doubtful value or which are imperfectly known have, as a rule, been omitted.

Forests as accumulators of nitrogen, E. Henry (*Bul. Soc. Forest. Franche-Comté et Belfort, 8 (1906), No. 7, pp. 681–695*).—The author discusses the increase in nitrogen content of soils on which forests are grown and cites the recent work of M. Süchting and L. Montemartini, which is confirmatory of the author's experiments in showing that the dead leaves of forests are capable of fixing a considerable amount of free atmospheric nitrogen (E. S. R., 16, p. 444).

Fertilizer experiments in forest nurseries, Schalk (*Forstw. Centbl., n. ser., 28 (1906), No. 11, pp. 569–579, pls. 3, fig. 1*).—The results are given of a number of experiments in fertilizing forest nursery trees. The experiments were carried out on rather swampy land 1,500 to 2,000 ft. above sea level and very subject to late spring frosts. The soil in the nursery was poor, as shown by the fact that spruce trees after 4 years stood hardly 15 cm. high.

When the soil was fertilized with 6 kg. Thomas slag, 3 kg. kainit, 1.5 kg. nitrate of soda per acre, the trees attained a height of 25 to 30 cm. at the end of 2 years. In a number of further experiments it was shown that fertilizing with composted lime, while giving good results, was surpassed in usefulness by complete fertilizers. Potash fertilizer was in no wise unnecessary, for it was only when this fertilizer was used that the full effect of phosphatic and nitrogenous fertilizers were obtained. This was true even on clay soils supposed to be well supplied with potash. Kainit appeared to be somewhat more effective early in the season than other forms of potash.

The use of lime in addition to Thomas slag increased the effect of the latter in a visible manner, but was not entirely necessary. Uninoculated lupines were of no benefit in preparing the land for nursery stock, but when inoculated they made a full development and produced practically as good results as other

forms of nitrogen. In all these experiments nitrate of soda, when used in combination with Thomas slag and kainit, was very effective.

Farm wind-breaks and shelter-belts, S. B. Green (*St. Paul, Minn.: Webb Pub. Co., 1906, pp. 69, figs. 26*).—The uses of wind-breaks and shelter-belts for the protection of farm buildings and stock, especially in the prairie States, are discussed and directions given for propagating and planting trees suitable for these purposes. Chapters are also given on landscape gardening, nursery practices, and tree protection.

Notes on rubber-producing plants, W. Harris (*Bul. Dept. Agr. [Jamaica], 4 (1906), No. 11, pp. 241–282*).—A large amount of information on the various rubber-producing plants has here been brought together in pamphlet form for the use of intending rubber planters in Jamaica. It is believed that the Lagos silk rubber (*Funtumia elastica*) will prove to be one of the best, if not the best, for many Jamaica districts.

DISEASES OF PLANTS.

Notes on plant pathology, G. Delacroix (*Bul. Mens. Off. Renseig. Agr. [Paris], 5 (1906), No. 11, pp. 1349–1363*).—Notes are given on a bacterial canker of poplar trees, a bacterial disease of potatoes, a disease of Carolina poplar, and a bacterial disease of onions.

The bacterial disease of poplar resembles in many respects the canker produced by *Nectria ditissima*, but a thorough study of the disease and its cause shows that it is due to a micrococcus, for which the author proposes the name *Micrococcus populi* n. sp. The organism has been isolated and studied. In the author's experiments he has failed to secure infection except where inoculations were made through punctures or injuries caused by hail or some insect. In this way he has been able to cause the disease in many instances, but only where cultures were used in which the organism had been grown in a medium containing an extract of the poplar bark. Where the disease is prevalent the author recommends the burning of infested trees, or, if the attack is a slight one, cutting out and burning the young branches.

The bacterial disease of potatoes described is that due to *Bacillus phytophthorus*, a disease which is known by the names black shank, stem rot, etc., in various parts of Europe. The author calls attention to the differences between the disease caused by this bacterium and that due to *Bacillus solanincola*. He reports that the bacteria are almost always accompanied by the mycelium of a species of Fusarium, an observation that seems to have been overlooked by other investigators.

The disease of Carolina poplar described is due to the fungus *Dothichiza populea*, and a study is given of the parasite, its method of attack, etc. The author recommends for its prevention the destruction of all dead branches, etc., which contain the fruiting bodies of the fungus, and spraying with Bordeaux mixture or other fungicide.

The bacterial disease of onions briefly described is said to be similar to, if not identical with, that mentioned by a number of authors, among them Stewart (E. S. R., 12, p. 56). For the prevention of this disease the rotation of crops and the addition of superphosphate of lime to the soil are recommended.

Fungoid pests of cultivated plants, M. C. Cooke (*London: Spottiswoode & Co., Ltd., 1906, pp. XV + 278, pls. 24, figs. 23*).—Brief popular and technical descriptions are given of a large number of fungi which are known to attack cultivated plants, together with suggestions for combating them. The material is grouped under the following heads: Pests of the flower garden, vegetable

garden, fruit garden and orchard, vinery and conservatory, ornamental shrubbery, forest trees, and field crops. These accounts are reprinted from the Journal of the Royal Horticultural Society (E. S. R., 14, p. 1090; 15, pp. 269, 689; 17, p. 158).

Cereal smuts and their propagation, T. JOHNSON (*Sci. Prog. Twentieth Cent., 1 (1906), No. 1, pp. 137-149*).—A summary of information is given relating to the more important grain smuts and notes are given regarding their propagation. The methods of infection by the different smuts are described at some length, and the use of fungicides for preventing smuts is commented upon, the remarks being based upon the methods of infection.

For the oat smut seed treatment is very efficient, as the infection takes place in the seedling stage of the plant, but with the wheat smut (*Ustilago tritici*) and the barley smut (*U. hordei*) the author claims that treatment with fungicides is of little avail, as the infection takes place during the flowering stages of the plants. For the prevention of smut of maize fungicides are valuable, as the infection is local and the presence of the fungicide on the plant prevents the germination of the adhering spores.

Oat smut and its prevention, O. APPEL and G. GASSNER (*Deut. Landw. Presse, 33 (1906), No. 89, pp. 704, 705, fig. 1*).—A description is given of the smut of oats due to *Ustilago avenæ*, and for its prevention the author describes the method of seed treatment with formaldehyde and the hot-water method. An account is given of a patented apparatus which is said to simplify the methods of hot-water treatment. Brief notes are given on the form of smut due to *Ustilago levis*, and for its prevention the methods described for the other species are recommended.

The physiology of the parasite of sore shin of cotton, W. L. BALLS (*Yearbook Khediv. Agr. Soc. Cairo, 1905, pp. 171-195, pls. 2*).—A study is reported of the sterile fungus described by Atkinson in Alabama College Station Bulletin 41 (E. S. R., 4, p. 832), which the author has found present and causing considerable injury in the cotton fields of Egypt. The characteristic appearance of the disease and its economic importance are described, after which notes are given on the fungus, its appearance in cultures, its temperature relations, parasitism, etc.

The author states that the Egyptian sore shin is identical with the disease known in this country, and the physiology of the parasite is relatively simple. Further studies are to be carried on as to the morphology of the organism, soil conditions, causes of irregular distribution, and means for prevention.

"Black root" disease of cotton, R. I. SMITH and A. C. LEWIS (*Ga. Bd. Ent. Bul. 22, pp. 237-275, figs. 12*).—An account is given of the black root or wilt of cotton due to *Neocosmospora vasinfecta*, which is becoming very troublesome in parts of Georgia.

After describing the cause of the disease, distribution, losses, etc., the authors consider means for reducing the loss. It is recommended that diseased plants should be dug up and burned, or where large areas of cotton are affected the stalks should be plowed out, raked, and burned in the fall as soon as the cotton is gathered. In this way the cotton roots and stems containing the fungus may be destroyed and the possibilities of spread will be lessened.

Experiments with Bordeaux mixture, copper carbonate, sulphur, carbolic acid, formalin, and applications of lime and kainit have failed to control or materially lessen the disease.

Variety tests have shown that certain varieties are somewhat naturally resistant to the black root or wilt, and that the resistant quality of some of these may be strengthened by careful selection of seed from the best plants.

Cotton growers are urged to follow out this selection, as it seems to be one of the most promising methods of combating the disease. The rotation of crops is also recommended.

The relation of nematodes to the disease is pointed out, the authors claiming that the presence of nematodes aids in its development.

A new alfalfa disease, W. PADDOCK (*Colorado Sta. Press Bul. 28, pp. 2*).—A brief account is given of a disease of alfalfa that has caused considerable damage in a number of localities in Colorado. In June, 1906, the author had the opportunity of inspecting infected fields during the growing season. The cause of the injury was apparent, as shown by the occurrence of numerous blackened stems from which a thick juice was oozing, plainly indicating that the plants were suffering from a bacterial blight. Subsequent examination showed that this was the probable cause of the disease.

The first evidence of disease to be noticed is a short, weak, light-colored growth of the first crop, the stems seldom averaging more than a foot in height at the time the first cutting is made. A close examination shows that the majority of these stems are discolored and are very brittle. The disease apparently does not kill many plants the first year, but in course of time so many plants die that the fields become useless.

Almost nothing is known of the blight as yet, and the horticultural section of the station solicits correspondence regarding its occurrence.

Potato leaf curl (*Roy. Bot. Gard. Kew, Bul. Misc. Inform., 1906, No. 7, pp. 242–245*).—After describing the leaf curl of potatoes, due to *Macrosporium solani*, attention is called to the fact that the fungus is perpetuated from year to year by mycelium in the tubers. When infested tubers are planted the mycelium grows along with the stem and enters the leaves, and also passes down into the young tubers. When only slightly infested with mycelium the further development in the tissues of the potato plant will depend on the weather conditions. It may do little harm beyond infecting the new tubers, or, if conditions are favorable, develop into an epidemic form and destroy the infested portions of the potato plant.

The fungus mycelium does not destroy the starch of the tuber, but lives only on the proteid substances, and it is practically impossible to tell by superficial methods whether a tuber is killed or not.

Owing to the fact that the conidia of the fungus are only produced on dead or dying plants, the epidemic is not increased by healthy plants having their foliage infested by the conidia, as in the potato blight. Young shoots may be infected late in the season, but the infection remains local and does not extend to the tubers. According to the author, the infection can only take place through the tuber, and this can be brought about either by planting diseased tubers or from conidia present in the soil.

A series of experiments has shown that the minimum temperature for germination of conidia is 47° F., with a maximum of 78° and an optimam of 64°. It is claimed that the resting spores of the fungus have germinated after having been kept in the laboratory for 6 months in a perfectly dry condition, and it is quite probable that they remain in the soil from one season to another without losing their power of germination.

Comparative studies have been made with the leaf curl of tomato (*Macrosporium tomato*), and inoculation experiments have proved that the two fungi are identical, the conidia from the tomato infecting potato plants and vice versa.

As practical means for combating these diseases, the author recommends planting potatoes from districts free from disease. The potatoes should not

occupy ground for at least 3 years where a diseased crop has been produced. All diseased stems should be collected and burned or deeply buried, and this should apply also to diseased tomato stems and fruit, otherwise the potato crop may be infested.

Soil treatment of tobacco plant beds, A. D. SELBY (*Ohio Sta. Circ. 59, pp. 3, fig. 1*).—In the spring of 1906 the author carried on some experiments to test the effect of solutions of formalin as a drench on old tobacco beds to destroy the bed rot (*Rhizoctonia* sp.).

The results were doubtful in some cases and favorable in others. In order to overcome some of the disadvantages of spring application fall treatments are recommended. The treatment consists of the application of a solution of formalin of the proportion of 2 lbs. formalin to 50 gal. of water, to be applied to the seed bed at the rate of 1 gal. to each square foot of surface. This treatment should be made before freezing weather begins, and the beds left without disturbance until spring, when they may be prepared for seeding.

A thorough trial of this method is recommended, which it is believed will not only keep down the Rhizoctonia, but also the damping-off fungus (*Pythium* sp.) and the black root due to Thielavia.

Diseased apples and melons from the Cape of Good Hope, G. MASSEE (*Roy. Bot. Gard. Kew, Bul. Misc. Inform., 1906, No. 6, pp. 193–196, pl. 1*).—Descriptions are given of diseased apples and melons which were forwarded to the Kew laboratory for examination.

In the case of the apple the disease is indicated by the appearance of minute, scattered, discolored blotches on the skin. After several weeks the blotches increase in size and at the same time become sunken or depressed below the surface. A microscopic examination showed the cells underlying each spot to be dead and collapsed and often crowded with starch grains, whereas the starch had entirely disappeared from healthy cells in the process of ripening. Neither fungi nor insects were found to play any part in the disease, which is considered to be of a purely physiological nature and caused by irregularities in the ripening of the fruit. It is probable that the injury to the fruit was due to too high temperature during the early period of ripening.

In the case of diseased melons the specimens exhibited small, roundish, pale-brown patches upon the surface of the rind, which on examination were found to be caused by the fungus *Macrosporium sarcinula*. Inoculation experiments showed that the conidia of the fungus was capable of infecting melons. The removal and destruction of diseased melons and thorough spraying with some fungicide on the first indication of the disease are recommended as preventive measures.

Pear rust, H. T. GÜSSOW (*Gard. Chron., 3. ser., 40 (1906), No. 1025, p. 134, figs. 2*).—A brief account is given of the pear rust fungus, which is the æcidial stage of *Gymnosporangium sabinæ*, and the author calls attention to a severe outbreak of the disease in England. The life history of the fungus is described at some length, and the fact that the fungus hibernates on the shoots of various species of Juniper is mentioned.

Spraying with Bordeaux mixture for the protection of the pear leaves is recommended, but the author thinks that this would be impracticable in large orchards and that a simpler remedy would be the destruction of the Juniper bushes, providing this should prove possible.

The development and prevention of the gray rot of grapes, J. M. GUILLON *Rev. Vit., 26 (1906), Nos. 659, pp. 117–124, figs. 3; 660, pp. 149–152; 661, pp. 181–186, dgms. 2*).—After describing the gray rot of grapes due to *Botrytis cinerea*, the conidial phase of *Sclerotinia fuckeliana*, an account is given of

the development of the conidial phase of the fungus, the methods of infection, and investigations for its control.

The conidia will not germinate at a very low temperature, and they are destroyed at a temperature beyond 35 to 38°. However, the temperature and moisture are frequently such as to produce very rapid growth. The primary infection takes place through the germination of spores in contact with the grapes, and the germ tubes soon penetrate the cuticle of the berry, usually through insect punctures or other wounds. From this primary infection the fungus spreads from berry to berry through contact, and on this account those varieties with very compact clusters suffer the most. The spread of the disease is shown to be very closely associated with the rainfall, rapid development following periods of abundant precipitation.

In experiments for the control of this disease the author made applications at 8 and 15 day intervals, covering a period of 2 or 3 months, of Bordeaux mixture, a mixture composed of nickel sulphate neutralized with lime, Bordeaux mixture to which sugar is added, verdigris solution, and solution of permanganate of potash, and in addition tested the value of powdered lime and plaster and sulphate of alumina. At the end of the season the grapes were gathered and the yields from the rows receiving the different treatments were compared.

It was found that the fungicides containing copper in soluble form, such as those containing sugar, verdigris solution, etc., gave better results than where the ordinary form of Bordeaux mixture was used. The nickel sulphate solution gave results comparable with or somewhat better than the others, but the high cost of the nickel sulphate precludes its use. The powders of lime and alumina gave good results, so far as the gray rot is concerned, but their manifest inferiority in combating mildew is against their recommendation for extensive use. Potassium permanganate for combating this disease proved of little value. For general use the author considers the sulphate of copper to be the best fungicide.

Some diseases of palms, E. J. Butler (*Agr. Jour. India, 1 (1906), No. 4, pp. 299–310, pls. 2*).—Accounts are given of diseases of a number of palms which have been under the author's observation. Among them is a disease of betel palms that is due to *Phytophthora* sp., another is a disease of the same tree caused by one of the higher fungi, probably a species of Fomes, and a third a disease of the palmyra palm caused by *Pythium* sp.

A new disease of cultivated veronicas (*Gard. Chron., 3. ser., 40 (1906), No. 1026, p. 150*).—A brief note is given on the occurrence of a fungus on *Veronica speciosa* and its varieties, which are in rather extensive cultivation. The fungus, which is said to be *Septoria exotica*, is met with occasionally during the summer, but it develops rapidly in autumn and winter when the plants are grown under glass. It produces small gray spots on the leaves, and in the course of 2 or 3 weeks the spots become white. Later the leaves fall, so that the plants assume a naked appearance with but few remaining leaves. The fungus has been observed in Argentina, Italy, and Germany. For the prevention of its attack, spraying with ammoniacal copper-soda mixture is recommended.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Revision of the skunks of the genus Spilogale, A. H. Howell (*U. S. Dept. Agr., Bur. Biol. Survey, North American Fauna No. 26, pp. 55, pls. 10*).—This genus of skunks has in general a southern distribution, reaching, however, into West Virginia, southern Minnesota, and Washington. The genus extends south-

ward into Central America and is represented in this territory, according to the present account, by about 20 species.

Notes are given on the habits and specific distribution of these animals. The food consists largely of insects, mice, and other small animals, as well as some vegetable material. A detailed description is given of each species with notes on its distribution.

The monthly bulletin of the division of zoology, H. A. SURFACE (*Penn. Dept. Agr., Mo. Bul. Div. Zool., 4 (1906), No. 6, pp. 209–240, pls. 2*).—Copies are given of a considerable number of official letters in the regular correspondence of the office of the economic zoologist regarding various insect pests and other matters.

Entomological section, C. W. HOWARD (*Transvaal Agr. Jour., 5 (1906), No. 17, pp. 168–176, pls. 3, fig. 1*).—*Bagrada hilaris* has been a serious pest on cabbages and cauliflowers in the Transvaal for several years. It attacks other cultivated and wild members of the mustard family. Since the pest is very fond of wild mustard, it may be trapped on this crop and sprayed with pure kerosene. Fairly good results have also been obtained from the use of resin wash.

Attention is also called to the attack of *Caradrina exigua* on tobacco, cotton, corn, and other plants. This pest feeds also upon pigweed and many other wild plants. A number of natural enemies are known, but if these are insufficient excellent results follow the spraying with Paris green.

An expedition for the study of plant pathology in Kamerun and Togo, 1904–5, W. BUSSE (*Tropenpflanzer, Beihefte, 7 (1906), No. 4–5, pp. 163–262, pls. 4, figs. 8*).—During the author's travels in Kamerun and Togo observations were made on the culture, insect pests, and plant diseases of cacao, rubber plant, cotton, cola, and other cultivated plants.

In the control of the fungus diseases of cacao, the author recommends the general use of Bordeaux mixture as giving results equally as satisfactory as those obtained with this fungicide in temperate regions. The author describes various special apparatus which may be suitable for spraying cacao trees.

A number of insects of minor importance are mentioned as attacking rubber trees in Kamerun. These include *Phrystola cocca*, *Glyphodes ocellata*, etc.

The varieties and forms of cotton grown in Togo are described, with notes on the cultural methods used in raising this crop. Many insect pests attack cotton in Togo and some of them are described, with notes on their life history, particular attention being given to *Earias insulana*, a pest which closely resembles our boll worm, *Dysdercus superstitiosus*, etc.

List of publications of the Bureau of Entomology, MABEL COLCORD (*U. S. Dept. Agr., Bur. Ent. Circ. 76, pp. 21*).—This list of publications of the Bureau of Entomology was compiled for the use of librarians and entomologists.

The slender seed-corn ground-beetle, F. M. WEBSTER (*U. S. Dept. Agr., Bur. Ent. Circ. 78, pp. 6, figs. 2*).—*Clivina impressifrons* is described, with notes on its distribution and habits. It attacks seed corn near the germ after the kernels have become softened by the moisture of the soil. In the spring of 1906 an unusual amount of injury was done. Damage is reported from Pennsylvania to Kansas, but in some localities a part of the injury may have been due to *Agonoderus pallipes*. No successful curative or preventive remedy has been devised.

Lita ocellatella on sugar beets, A. GIARD (*Compt. Rend. Acad. Sci. [Paris], 143 (1906), No. 18, pp. 627–630*).—Some difference of opinion has existed as to the identity of this insect, which is well known in France as an enemy of sugar beets. The life history of the pest is briefly described and notes are given on its feeding habits.

The potato moth, C. FRENCH (*Jour. Dept. Agr. Victoria, 4 (1906), No. 10, pp. 577–582, pl. 1*).—A description is given of *Phthorimaea operculella* in all its stages. In combating the pest the author suggests the use of lantern traps, lime sprinkled on potatoes in storage, a careful examination of seed potatoes before planting, and the use of gas lime at the rate of 30 bu. per acre on the soil after the potatoes have been dug.

Thrips or black fly, W. W. FROGGATT (*Agr. Gaz. N. S. Wales, 17 (1906), No. 10, pp. 1005–1011, pl. 1*).—The habits and essential features of the life history of thrips are briefly outlined with special notes on some of the more interesting species in New South Wales. These include *Thrips tabaci*, *Heliothrips haemorrhoidalis*, *Idolothrips spectrum*, etc.

These insects may usually be destroyed by fumigation with tobacco or hydrocyanic-acid gas.

The melon aphis, F. H. CHITTENDEN (*U. S. Dept. Agr., Bur. Ent. Circ. 80, pp. 16, figs. 6*).—The melon aphis (*Aphis gossypii*) is generally distributed throughout the United States but is especially injurious in the Southwest. It attacks a great variety of economic plants belonging to different families. The natural enemies of the pest are ordinarily not sufficient to hold it in control. It may be destroyed by fumigation with carbon bisulphid or by the use of pyrethrum, tobacco fumes, or kerosene emulsion. Treatment with kerosene emulsion has the advantage that it is also destructive to a considerable variety of other insects which attack cultivated plants in conjunction with the melon aphis.

Spraying to control the San José scale, R. I. SMITH (*Ga. Bd. Ent. Bul. 21, pp. 201–236, figs. 19*).—As a result of further experiments with lime-sulphur washes in the control of the San José scale, the author recommends a boiled lime-sulphur wash. Salt does not appear to be necessary or desirable, but the lime used should be a calcium lime rather than a magnesia lime. Self-boiled lime-sulphur washes are often used with good success but are more expensive and not quite so satisfactory as boiled washes. For spraying on a large scale, steam-boiling outfits are most satisfactory. It is recommended that badly infested orchards be sprayed in the fall and in the spring, but where 2 sprayings are impossible the applications should be made in the spring.

Soluble oils as destroyers of San José scale, H. A. GOSSARD (*Ohio Sta. Circ. 60, pp. 4*).—The station has continued its work with proprietary preparations of soluble oils (E. S. R., 17, p. 993) with the result that these materials appear to compare favorably with lime-sulphur wash in effectiveness as remedies for scale insects. In general they may be diluted in water so as to form 5 per cent solutions.

It is suggested, however, that the variable results obtained with soluble oils indicate a variation in composition, and when safety, cost, and efficiency are considered, the author recommends lime sulphur as the best remedy.

Insect pests affecting fruit trees, C. P. LOUNSBURY (*Agr. Jour. Cape Good Hope, 29 (1906), No. 4, pp. 500–511*).—The cultivation of crops over large areas offers better opportunity for indefinite multiplication of injurious insects than would be found in a state of nature. The author calls attention to the development of arsenical poisons and to their application in the control of injurious insects. Particular mention is made of the codling moth and of the little help which can be expected from its parasites.

A plague of Macrodactylus mexicanus in the valley of Mexico, J. R. INDA (*Com. Par. Agr. [Mexico], Circ. 46, pp. 8, figs. 2*).—This pest is a serious enemy of horticulture and attacks a considerable variety of plants. In combating the

insect the author recommends the use of a mechanical mixture of kerosene and water.

Caterpillar plagues, A. L. HERRERA (*Com. Par. Agr.* [*Mexico*], *Circ. 45, pp. 14, figs. 7*).—Brief mention is made of outbreaks of leaf-eating caterpillars on cabbage, grapes, sugar cane, cotton, and other fiber plants. Directions are also given for the preparation of arsenical insecticides for controlling these pests.

The caterpillar pest of indigo in Behar, H. M. LEFROY (*Agr. Jour. India, 1* (*1906*), *No. 4, pp. 338–350, pl. 1, fig. 1*).—In some seasons the young indigo is badly damaged by the attacks of *Caradrina exigua*. This insect is described in its different stages with notes on its life history. The pest prevails in large numbers in April and May. Occasionally the insect is found on alfalfa and other crops, but does not do as much damage on them as on indigo. According to practical experience with this pest the Java-Natal indigo is almost immune and it is recommended that this variety be planted instead of Sumatrana indigo. In some locations the use of alfalfa as a trap crop may also give favorable results.

The red slug caterpillar; a serious pest of the tea plant, H. H. MANN (*Indian Tea Assoc.* [*Pamphlet*] *5, 1906, pp. 14, pls. 2*).—This pest was first observed on tea in 1895 and has since become very injurious. The eggs are laid in masses on the under side of leaves or on the main trunk of tea bushes. The egg-laying and hatching occupy about 12 days, while the larval period extends over 5 weeks and the pupal period over 21 days. A number of natural enemies are known, but these do not keep the pest in check. Unfortunately experiments thus far carried on with arsenicals have given rather unsatisfactory results. The pest may best be controlled by hand picking and this has been found to be quite a simple undertaking. The pest in question is referred to as *Heterusia cingala*.

The production of golden colored pupæ with Vanessa urticæ and V. io, E. MENSIK (*Ztschr. Ent., n. ser., 1906, No. 31, pp. 15–18*).—The author accidentally discovered a number of bright golden pupæ of *Vanessa urticæ* and some of a lighter color in *V. io*. An attempt was made to produce this color by a definite line of feeding the larvæ. It was found that when larvæ of *V. urticæ* were fed on nettle leaves from wet situations, the resulting pupæ showed a rich golden color in from 8 to 30 per cent of cases.

A supposed difference in the coloring matter of oak leaves and the silk of Saturnia yama-mai, C. GAUTIER (*Compt. Rend. Soc. Biol.* [*Paris*], *61* (*1906*), *No. 33, pp. 419, 420*).—It has been maintained that the green coloring matter of the cocoon of the *Saturnia yama-mai* may be differentiated from the chlorophyll of oak leaves by its insolubility in cold alcohol. The author shows, however, that both coloring matters are soluble in the same reagents.

Number of eggs of Samia cecropia, Pulvinaria innumerabilis, and Culex pipiens, J. J. DAVIS (*Ent. News, 17* (*1906*), *No. 10, pp. 368, 369*).—As a result of repeated observations the author finds that the average number of eggs laid by a female *Samia cecropia* is 243.9, for *Pulvinaria innumerabilis* 3,410.2, and for *Culex pipiens* 178.4.

Camnula pellucida (*Com. Par. Agr.* [*Mexico*], *Circ. 47, pp. 7, figs. 6*).—This grasshopper causes considerable injury to grasses and cultivated crops in Mexico. In combating the pest the author recommends the cultivation of the breeding grounds, the use of hopperdozers, and spraying with crude petroleum or Paris green.

A scale insect of the cocoanut palm, E. FLEUTIAUX (*Agr. Prat. Pays Chauds, 6* (*1906*), *No. 41, pp. 166–168*).—In western Africa, particularly in Dahomey, a scale insect was observed in large numbers on the cocoanut palm which proved to be *Aspidiotus destructor*. A mixture containing soda and resin is recommended as a spray for this pest.

The large larch sawfly (Nematus erichsoni), R. S. MacDougall (*Jour. Bd. Agr. [London], 13 (1906), No. 7, pp. 385–394, pl. 1*).—According to the author's observations this insect makes its most persistent attacks upon trees 20 to 70 years old, but may injure much younger trees. Little can be accomplished in fighting the adult insect, but the larvæ may be destroyed by jarring or by spraying with hellebore or arsenicals. Some help is also received from birds and other natural enemies of the pest.

The maple leaf-stem borer or sawfly, W. E. Britton (*Ent. News, 17 (1906), No. 9, pp. 313–321, pl. 1, fig. 1*).—An insect attack upon the petioles of the leaves of the sugar maple has been observed in some localities in Connecticut for the past 7 years. The larvæ of this pest develop from an egg laid at the base of the leaf and burrow through the petiole, which finally breaks off, causing the leaves to be shed in May or June. The insect has been identified as *Priophorus acericaulis*, a species of sawfly.

A few parasites have been reared from specimens of the sawfly. No good results can be expected in controlling this pest by application of insecticides to the tree. It is suggested, however, that since the larvæ fall from the tree and enter the ground about June 15, a large proportion of them might be destroyed by spraying the soil at this time with kerosene emulsion.

Constriction of twigs by the bag worm and incident evidence of growth pressure, H. von Schrenk (*Mo. Bot. Gard. Ann. Rpt., 17 (1906), pp. 153–181, pls. 9, figs. 4*).—It was noted that bag worms in attaching the band which holds the bag around the small twigs of arbor vitæ caused a swelling at the point where the band was applied and the subsequent death of the terminal portion of the twig. An anatomical study was made of the changes set up in the tissue of the twigs as a result of the attachment of the bag worms. A brief bibliography of the subject is appended to the article.

The recently introduced dung fly parasite, J. Kotinsky (*Hawaii. Forester and Agr., 3 (1906), No. 10, pp. 319–321*).—A number of specimens of *Eucoila impatiens* have been introduced and successfully colonized in Hawaii. This parasite attacks insects which live in dung. It is hoped that they will be of some benefit in controlling the horn fly.

The British woodlice, W. M. Webb and C. Sillem (*London: Duckworth & Co., 1906, pp. X+54, pls. 25, figs. 59*).—A monographic account is given of this group of Crustacea which are commonly known in the United States as sow bugs. The various species are described in detail and a bibliography of the subject is presented. Mention is also made of the economic relations of such species as are known to attack cultivated plants.

Ants, F. Knauer (*Ameisen. Leipsic: B. G. Teubner, 1906, pp. 156, figs. 61*).—This is a general treatise on the biology of ants and contains a discussion of the various forms found in ant colonies, care of the brood, construction of nests, and symbiosis of ants with other species of ants, unrelated insects, and plants.

The ant, K. Escherich (*Die Ameise. Brunswick: F. Vieweg & Son, 1906, pp. 232, figs. 68*).—In presenting a general account of ant biology the author makes a study of the geographical distribution and classification of ants, following this with a discussion of their morphology, anatomy, polymorphism, methods of reproduction, construction of nests, feeding habits, symbiotic relations, and intelligence.

Harvest mites, or "chiggers," F. H. Chittenden (*U. S. Dept. Agr., Bur. Ent. Circ. 77, pp. 6, figs. 3*).—The pests commonly known as "chiggers" are the larval forms of harvest mites and are found on bushes, trees, and grass from which they infest man, burrowing in the skin and causing more or less serious inflammation. The remedies suggested by the author are hot baths with salt

and strong soap within a few hours after exposure, or the sprinkling of sulphur in the underclothes before going into localities where chiggers prevail. Various other local treatments may be applied such as soda, iodin, or alcohol, but the effects are usually temporary.

The destruction of mosquitoes in houses with pyrethrum, A. L. HERRERA (*Com. Par. Agr. [Mexico], Circ. 48, pp. 5, figs. 2*).—According to the author's experience houses may be ridden of mosquitoes by the thorough use of pyrethrum. The powder is distributed by means of small hand bellows and is not injurious to man even if applied in excess.

Contributions to the study of silkworms, K. TOYAMA (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), No. 2, pp. 225–393, pls. 7, chart 1*).—The author finds that polygamy is a normal habit of the silkworm and that fertilization is much more influenced by the condition of the females than by that of the males.

A parasitic fly (*Tachina rustica*) is reported as causing great losses among silkworms in Siam. The egg of the parasite is laid on the skin of the silkworm and the larva bores into the host. The parasite is described in its various stages. It appears to be distributed throughout the Indo-Chinese peninsula, in some cases from 70 to 80 per cent of the silkworms in a restricted locality being parasitized. The Siamese protect the silkworms by wrapping cotton cloth around each worm basket, while the Chinese use mosquito netting upon windows and doors.

A long series of experiments was carried on in crossing silkworms with special reference to determining whether the results conform with Mendel's law. It appears that in general the color of the cocoon and the egg and the various larval markings are inherited in accordance with Mendel's law, while the shape of the cocoon and various other characters follow some other law.

The length of the tongue of bees, N. KULAGIN (*Zool. Anz., 29 (1906), No. 24, pp. 711–716*).—A large number of measurements were made of German bees, American red-clover bees, and other varieties for the purpose of determining the relative length of the tongue. The tongue of dark races of bees in America and Russia appears to be distinguished by its length. Careful measurements, however, indicate but little difference in the length of these bees and dark German races. The average length of the tongue of dark bees was 6.21 mm. and of red clover bees 6.22 mm., the greatest observed length being 6.69 mm. in the dark bee. The average length of the tongue of Italian bees is greater than that of dark bees, while the longest tongues were found in Cyprian bees, the average being 6.5 mm.

Since the length of the nectar tube in red clover is 9 to 10 mm., it is evident that the existing races of bees are not capable of extracting honey from this plant.

The respiratory organs of bees, S. DYACHENKO (*Izv. Moscov. Selsk. Khoz. Inst. (Ann. Inst. Agron. Moscou), 12 (1906), No. 1, pp. 1–14, figs. 9*).—The anatomical features of the respiratory organs of bees are described in considerable detail by way of comparison with the respiratory organs of other insects.

The swarming of bees, SOPHIE DIATSCHENKO (*Ztschr. Wiss. Insektenbiol., 2 (1906), No. 9, pp. 285–288*).—The study of the causes and means of regulating the swarming of bees has always proved an interesting one to the entomologist and practical bee raiser. According to the author's observations swarming is more likely to occur in times of heavy or very light honey yield than during the period of moderate flow of honey. The regulation of swarming may easily be accomplished by furnishing a moderate amount of room for the bees of each colony.

The number of bees in a colony, J. DEVAUCHELLE (*Apiculteur, 50 (1906), No. 9, pp. 322–326*).—In estimating the weight and number of bees in a colony

more care should be exercised than is usually given to this matter. The author believes that as a rule there are about 10,000 bees per kilogram of weight.

Water for bees, R. BETHUNE (*Jour. Dept. Agr. Victoria, 4 (1906), No. 10, pp. 632–634, fig. 1*).—Attention is called to the desirability of having a suitable water supply conveniently arranged for the use of bees. A practical apparatus for supplying water is described and illustrated.

Evaporation from hives at night, A. MAUJEAN (*Apiculteur, 50 (1906), No. 9, pp. 326–332*).—The loss of weight which takes place as a result of evaporation in hives during the night depends somewhat on the rapidity with which the bees cap over the cells already filled with honey. This process is delayed somewhat and a larger loss takes place than would otherwise be the case, but this is a matter which can not be controlled.

Artificial comb foundation, R. PINCOT (*Apiculteur, 50 (1906), No. 10, pp. 361–368*).—According to the author's observations, bees, if left to themselves, construct the worker cells according to their own anatomical proportions. The cells are, therefore, larger or smaller, according to the size of the bees which made them.

By starting the foundation in a matrix which gives comparatively large bases for the cells, larger cells are made and the worker bees which develop in such brood cells are larger than they otherwise would have been. Attention is called to the advantages of large size in bees and a description is given of the methods by which bees draw down the foundation to form the cell walls.

The bacteria of the apiary, with special reference to bee diseases, G. F. WHITE (*U. S. Dept. Agr., Bur. Ent. Bul. 14, tech. ser., pp. 50*).—Reference has been made to previous work of the author along the line of bee diseases (E. S. R., 16, p. 487), and the present bulletin contains a summary of the work thus far done.

In the first part of the bulletin descriptions are given of bacteria commonly found in the combs or pollen, and in or upon honey bees and other material with which they come in contact. Detailed statements are made regarding the behavior of these bacteria upon different nutrient media. As a rule, honey from the healthy hive is sterile. A number of bacteria, however, occur upon the comb and in the intestines of healthy bees.

As a result of the author's investigations the name European foul brood is given to the disease in which *Bacillus alvei* was found, while American foul brood is a term reserved for the brood disease due to *B. larvæ*. Both of these diseases have a similar distribution. So-called black brood is apparently identical with European foul brood and the term is therefore abandoned. Pickle brood and paralysis are not yet understood.

The brood diseases of bees, E. F. PHILLIPS (*U. S. Dept. Agr., Bur. Ent. Circ. 79, pp. 5*).—Two forms of brood disease commonly known as European and American foul brood are recognized in this country. American foul brood is distributed throughout nearly all parts of the United States, while European foul brood or black brood is not so widespread, but has caused great losses in many localties and is steadily on the increase.

The symptoms of these diseases are described and remedies are outlined. Drugs are of little avail and colonies may be treated by shaking into clean hives or excluding from old infested hives by means of bee escape.

Brief notes are also given on the symptoms of pickle brood and the conditions commonly known as chilled, overheated, and starved brood.

The enemies of bees, A. CAILLAS (*Apiculteur, 50 (1906), No. 11, pp. 410–416, figs. 4*).—Attention is called to a number of the natural enemies of bees, including certain grasses, swallows and other bee-eating birds, spiders, and parasitic moths.

FOODS—HUMAN NUTRITION.

Food and nutrition, ISABEL BEVIER and SUSANNAH USHER (*Urbana, Ill.: Authors, 1906, pp. 45*).—In this volume, which is designed primarily for the use of students in the household science department of the University of Illinois, a considerable number of experiments have been selected from a variety of sources for laboratory instruction on protein, fats, carbohydrates, meat, milk, and other foods, and on the digestion of proteids and starches.

The manual is expected to serve two purposes: "First, to aid the student to recall and to arrange in an orderly way the knowledge gained from other sources; secondly, to apply this knowledge, in so far as possible, to various kinds of food problems and so to serve as an introduction to individual work with foods which follows." A bibliography is appended which contains references to works in which the student can find fuller information.

Modern diet (*Brit. Med. Jour., 1906, No. 2384, pp. 581, 582*).—A critical discussion of nutritive requirements and of dietary standards with special reference to recent work on the subject. It is conceded that no immediate harm results to healthy individuals from a low proteid diet and that this conclusion is of importance in connection with diseases involving the kidneys and digestive organs. That many persons undoubtedly take excessive amounts of proteids in their diet is also pointed out. "We do not think, however, that it has been proved that a diet containing proteid in a much smaller proportion than that of 100 gm. a day for an adult of 70 kg. is permanently beneficial either to the individual or to the race and especially for those whose occupations require considerable muscular exertion. It appears, on the contrary, from the evidence at present at our disposal, that such a permanent reduction is not without possible danger to the virility of the nation."

The diet of the precibiculturists, H. CAMPBELL (*Brit. Med. Jour., 1905, Nos. 2322, pp. 40, 41; 2325, pp. 208, 209; 2328, pp. 350–352; 2329, pp. 406–409; 2333, pp. 665, 666; 2335, pp. 813–815; 2337, pp. 979–981; 2340, pp. 1217–1219; 2347, pp. 1658, 1659*).—A general discussion of prehistoric, savage, and semisavage tribes and their habits, special attention being paid to food, methods of preparation, and related questions.

The food of well-to-do classes, E. BIERNACKI (*Zentbl. Gesam. Physiol. u. Path. Stoffwechsels, n. ser., 1 (1906), No. 13, pp. 401–403*).—The data collected regarding the food of 30 well-to-do families in Warsaw and Lemberg showed that the protein supplied per person per day varied from 78 to 195 gm. and the energy from 2,110 to 4,010 calories, being on an average 121 gm. protein and 3,015 calories.

Food and digestion in warm climates, J. CANTLIE (*Jour. Trop. Med. [London], 9 (1906), No. 20, pp. 312–316*).—The author calls attention to the fact that rice occupies much the same place in the oriental dietary as bread fills in that the western nations, and that the importance of this foodstuff is very commonly greatly overestimated in discussions of the diet of oriental races.

In his discussion of Chinese dietary habits, which is based on personal experience, the author states that "their early morning meal consists of soft-boiled rice 'conjee,' . . . The forenoon meal, or breakfast, consists of fish, or fat pork, vegetables, rice, and tea. The midday meal may be again soft-boiled rice, but the afternoon or evening meal consists also of fish, pork, vegetables, rice, and tea. The rice is in no larger proportion to the meal, perhaps not quite so large, than is bread in the European breakfast."

The food materials, particularly of animal origin, which are available in tropical regions are discussed, as well as other general topics. Attention is directed to the extended use of hot spices, particularly in the form of curry.

"The use of pepper is, of course, an oriental custom, and the stronger forms of pepper seem requisite as an article of diet. The therapeutic use of pepper seems to be not so much a stomachic tonic as an intestinal stimulant, and chiefly as a stimulant to the large intestine."

A diet with and without meat and a vegetarian diet, K. BORNSTEIN (*Ther. Gegenwart, 47 (1906), No. 5, pp. 193–198*).—The author speaks in favor of a mixed diet with a moderate amount of meat, though he recognizes the fact that a diet without meat may be entirely sufficient provided care is taken to secure a sufficient amount of digestible protein. He states that an excessive amount of meat increases intestinal fermentation and uric acid, while this is not the case with a vegetarian diet.

The hay-box cook book, SARAH P. REDFIELD (*Chicago: Author, 1906, pp. 36*).—As the author points out, the principle underlying the so-called hay-box cookery is the retention of heat in materials which have been brought to a boiling point on a range or stove. This is accomplished by surrounding the vessel containing the hot food with nonconducting material.

The construction of a homemade hay-box cooker is described, and detailed directions given for the preparation of a number of foods with such a cooker.

Fireless cooking, H. G. SHARPE (*Rpt. Commis. Gen.* [*U. S. Army*], *1906, pp. 14–18*).—A brief progress report is made of experiments on cooking by surrounding the hot food with nonconducting material. "Exhaustive experiments have been made, not only in cooking in garrison, but also in the field under varying conditions, and the results in both instances have been gratifying."

Some data are also given regarding army training schools for bakers and cooks, emergency rations, an especially constructed kitchen car and other questions concerning army rations or their preparation.

Good luncheons for rural schools without a kitchen, ELLEN H. RICHARDS (*Boston: Whitcomb & Barrows, 1906, pp. 12*).—As the author points out, satisfactory lunches for school children may be prepared with the simplest apparatus by cooperation on the part of pupils and teachers. Such an enterprise should include instruction in home economics, and suggestions are made for carrying on the work in schools without interfering with the regular curriculum. Data are quoted showing the satisfactory results which have attended such efforts.

The bleaching of flour, E. FLEURENT (*Compt. Rend. Acad. Sci.* [*Paris*], *142 (1906), No. 3, pp. 180–182*).—According to the author, the only satisfactory commercial method for the bleaching of flour depends upon the use of nitrogen dioxid produced either by chemical means or by the action of an electric arc in the atmospheric air. The quantity of oxid of nitrogen (calculated as dioxid) required for bleaching varies from 15 to 40 cc. per kilogram flour and varies according to the nature of the flour. The action of the nitrogen dioxid is due mainly to the formation of additive products with the flour fat as shown by the fact that the iodin numbers are increased.

Bleaching with nitrogen dioxid may be detected by methods based on the color tint of the saponified fats. It does not affect the diastase or the various ferments of flour. The resistance of the fats to saponification is directly proportional to the amount of the dioxid absorbed.

The action of ozone on flour is markedly different from that of nitrogen peroxid and also from the slow action of atmospheric air. Ozone increases the iodin value and favors the production of volatile fatty acids, while nitrogen peroxid does not. On the other hand, 4 months exposure to air nearly doubles the total acid content in normal flour, while ozone has no effect on total acid.

Liebig's meat extract, II, F. KUTSCHER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 10, pp. 582–584*).—Continuing earlier work (E. S. R., 17,

p. 790) the physiological and chemical properties of newly identified constituents of meat extract were studied. Ignotin was found to have no physiological action. Oblitin and novain, on the other hand, in experiments with animals, caused illness. Oblitin undergoes cleavage in the body, the principal cleavage product, novain, being found in both urine and feces, and apparently there is a close relation between these two bases.

Composition of Italian tomato juices, C. FORMENTI and A. SCIPIOTTI (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 5, pp. 283–295*).—Detailed analyses are reported of a number of samples of tomato juices, concentrated tomato extract, and tomato fruits.

As regards the amount of salicylic acid naturally occurring in the tomato, the figures given range from 15 to 25 mg. per kilogram of fresh fruit juice. A study of the tin in canned tomato juices showed that there was a marked increase if the material was allowed to remain in the can after opening.

Concerning the composition of tomatoes and tomato juice, W. STÜBER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 10, pp. 578–581*).—Proximate and ash analyses are reported. Apparently all the acid present was citric acid. In no case was tartaric, malic, or succinic acid found. Fructose was more abundant in the juice than glucose.

Some data are also given regarding the examination of a commercial tomato purée.

Concerning elderberry juice, H. LÜHRIG (*Pharm. Centralhalle, 46 (1905), pp. 829–831; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 8, p. 485*).—Analyses of 10 samples of elderberry juice are reported.

Honey, T. MACFARLANE (*Lab. Inland Rev. Dept. [Canada] Bul. 122, pp. 11*).—Of 54 samples of honey examined 9 were adulterated, although in only one case was adulteration declared.

Adulterated glucose used in candy making, C. D. HOWARD (*N. H. Sanit. Bul., 2 (1906), No. 12, pp. 209–211*).—Glucose, according to the author, enters to a greater or less extent into the manufacture of practically all the cheap candy now on sale. To overcome a tendency to stickiness some confectioners make a practice of adding a concentrated solution of bisulphite of soda to the glucose. Bisulphite of soda is also used as a bleaching agent in the manufacture of glucose. Examination of a number of samples of confectioners' glucose showed the presence of sulphite equivalent to 0.0448 to 0.1056 gm. of the free acid per 100 gm. glucose. In one sample no sulphurous acid was found. In cheap candies examined the sulphurous acid ranged from traces to 0.036 gm. per 100 gm. of candy. Two of the samples contained no sulphurous acid.

"Whether the bisulphite is added by the refiner on account of any specific advantage accruing from such to the confectioner, or whether such use is for bleaching purposes, is immaterial in connection with the point at issue which is that the presence of such material, under the law, constitutes an adulteration, and vendors of candy thus adulterated will be liable to prosecution."

Food materials and their adulterations, ELLEN H. RICHARDS (*Boston: Whitcomb & Barrows, 1906, 3. ed., pp. VIII+176*).—Information is summarized regarding the principles of dietetics, the characteristics of the more important food materials, the more usual forms of food adulteration and sophistication, and related questions. The volume has been revised to include new material which has accumulated since it was first published. A bibliography is appended.

Simple household tests for the detection of adulterations in foods, J. PETERSON (*Salt Lake City: Utah Dairy and Food Commission, 1906, pp. 15*).—In this pamphlet, which was prepared by the Utah Dairy and Food Commission, simple tests are given to aid the housewife to determine the character and quality of a number of common foods.

Report of food inspection, C. D. HOWARD (*N. H. Sanit. Bul., 2 (1906), No. 12, pp. 198–209*).—Of 188 samples of canned meats, soups, and vegetables, candies, dried fruits, flavoring extracts, sirup, spices, coffee, cocoa, etc., 186 samples were found to be adulterated, misbranded, or below the required standard.

Food inspection in Saxony, C. B. HURST (*Mo. Consular and Trade Rpts. [U. S.], 1906, No. 313, pp. 121–124*).—In Saxony the inspection of food is under the direct control of the government and is organized into 2 state institutions, 3 municipal inspection laboratories, and 11 subordinate laboratories. The operation of the law is briefly described. According to the author, marked benefits have resulted from this food inspection.

The effect of preservatives, A. BEHRE and A. SEGIN (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 8, pp. 461–467*).—The preservative powers of formaldehyde, benzoic acid, salicylic acid, boric acid, sodium benzoate, sodium thiosulphate, sodium sulphite, and a commercial preservative were tested with meat juice. Formaldehyde gave the best results. At the end of 13 days the meat juice preserved with it was unchanged as regards color and odor. Of the other materials tested the acids gave better results than the salts.

Influence of food preservatives and artificial colors on digestion and health. II, Salicylic acid and salicylates, H. W. WILEY (*U. S. Dept. Agr., Bur. Chem. Bul. 84, pt. 2, pp. VI+479–760, figs. 3*).—The experiments here reported in full have been noted from the author's summary of results (E. S. R., 18, p. 462).

The injurious effects of sulphurous acid and its compounds with special reference to free sulphurous acid, H. WALBAUM (*Arch. Hyg., 57 (1906), No. 2, pp. 87–144*).—An aqueous solution of free sulphurous acid, like the gaseous form, is very irritating and often more or less injurious. Very small amounts, 4 or 5 mg. in the form of a 0.02 per cent solution or certainly 10 mg. in a 0.04 per cent solution, cause subjective symptoms in man. The salts are similar in their effects to the acid, owing to the fact that the free acid is liberated in the digestive tract. Compounds of sulphurous acid with glycose and acetaldehyde are the principal organic forms in which it occurs. In no case should sulphured fruits contain more than an equivalent of 10 mg. of the acid per 100 gm.

The question of sulphurous acid compounds in wine is also considered.

Determining the limits within which sulphurous acid in foodstuffs is harmful, JAKOBJ and H. WALBAUM (*Arch. Expt. Path. u. Pharmakol., 54 (1905), No. 6, p. 421; abs. in Zentbl. Physiol., 20 (1906), No. 8, p. 288*).—The investigations reported have been noted above from another publication.

The mechanics of stomach digestion, A. SCHEUNERT (*Arch. Physiol. [Pflüger], 114 (1906), No. 1–2, pp. 64–92, figs. 30*).—From a number of experiments the conclusion was reached that foods taken one after the other form layers in the stomach and do not mix. The formation and persistence of the layers is influenced by the anatomical structure of the stomach, its position in the abdominal cavity, and other conditions.

The failure of stomach contents to mix explains why with herbivora starch digestion may progress actively at the cardiac end of the stomach where lactic acid is present in abundance and other fermentations are taking place, though it ceases in other portions where hydrochloric acid is present.

The theory that throughout its progress stomach digestion is of the same character and that the stomach contents are a uniform mixture is, in the author's opinion, erroneous.

The mechanics of stomach digestion, ELLENBERGER (*Arch. Physiol. [Pflüger], 114 (1906), No. 1–2, pp. 93–107*).—On the basis of the preceding article and earlier work (E. S. R., 17, p. 485) the mechanics of stomach digestion is discussed.

The energy required for the work of digestion, O. COHNHEIM (*Arch. Hyg., 57 (1906), No. 4, pp. 401–418*).—Digestion requires more energy production than hunger, the amount measured in the experiment reported being 3.3 calories equivalent to 0.98 gm. carbon dioxid or 0.35 gm. fat, an increase of 9 per cent of the minimum energy metabolized per day at rest and in a warm room, and not over 1 per cent of the output of energy per day under normal conditions. This increase is due to the work of the digestive organs. The total nitrogen excretion was not increased. It appears, therefore, that the work of digestion, like muscular work, is carried on at the expense of nitrogen-free nutrients.

The digestion of protein and its function in general nutrition, LAMBLING (*Rev. Sci. [Paris], 5. ser., 6 (1906), No. 18, pp. 545–551*).—A summary and discussion of recent work pertaining to the cleavage and digestion of proteids.

Peptic digestion, P. MEY (*Ztschr. Physiol. Chem., 48 (1906), No. 1, pp. 81–84*).—The albuminoses formed in gastric digestion can be almost completely precipitated by the use of tannin, a peptone remaining in the filtrate.

The effect of different substances upon artificial peptic digestion, J. VON FUJITANI (*Arch. Internat. Pharmacod. et Thér., 14 (1905), p. 1; abs. in Hyg. Rundschau, 16 (1906), No. 19, pp. 1083, 1084*).—Among the materials studied were tea, coffee, and sugar products.

Tea and coffee in concentrated solution were found to have an unfavorable effect upon peptic digestion directly proportional to the degree of concentration. Apparently the caffein present did not exercise any effect upon digestion. Sugar solutions of over 0.5 per cent concentration had a retarding effect upon digestion.

New comparative studies of natural and artificial digestion of protein, W. ROTHE, H. WANGNICK, and A. STUTZER (*Jour. Landw., 54 (1906), pp. 257–264*).—The same results were obtained in artificial digestion experiments as in the natural experiments with rabbits, the feeding stuffs used being wheat, bran, and meadow hay.

Muscular work and protein metabolism, W. SAWJALOW (*Ztschr. Physiol. Chem., 48 (1906), No. 2, pp. 85, 86*).—An examination of liquid which was passed through isolated cat and rabbit hearts kept at work from 1 hour and 30 minutes to 2 hours and 30 minutes showed that it was almost entirely free from ammonia and from urea. This led to the conclusion that muscular work was apparently performed without the cleavage of protein.

The physiology and pathology of mineral metabolism, with tables showing the ash constituents of foods, condiments, and mineral waters, A. ALBU and C. NEUBERG (*Physiologie und Pathologie des Mineralstoffwechsels nebst Tabellen über die Mineralstoffzusammensetzung der menschlichen Nahrungs- und Genussmittel sowie der Mineralbrunnen und- Bäder. Berlin: Julius Springer, 1906, pp. 247; rev. in Zentbl. Gesam. Physiol. u. Path. Stoffwechsels, n. ser., 1 (1906), No. 14, p. 464*).—Among the subjects considered in this handbook are the water and ash content of the human body, the ash content of different organs, blood, and secretions; the dynamics of salt action; the physical-chemical action of salts; metabolism of calcium, magnesium, and other individual ash constituents; iodin, arsenic, and other elements occurring in small quantities; the therapeutics of ash constituents, and a critical discussion of methods of ash analysis. The tables contain a summary of data which the authors consider reliable, supplemented by the results of many original analyses.

As a whole, this volume constitutes a useful handbook on a subject on which hitherto information has been inadequate and widely scattered.

Influence of the quality and quantity of protein consumed upon the elimination of uric acid xanthin compounds in normal man, H. LABBÉ and L. FURET (*Compt. Rend. Soc. Biol. [Paris], 61 (1906), No. 27, pp. 214–216*).—Experiments showed that the amount of uric-acid xantho bodies produced from

protein of different sorts varied considerably, the following amounts being obtained per 100 gm. of the proteids studied: Herring 2.81 per cent, beef 1.65 per cent, macaroni 1.58 per cent, egg 1.56 per cent, and milk 0.71 per cent.

In a second test, milk, gruyère, and white cheese were compared, the amount of xantho uric bodies formed being greatest with the milk and least with the white cheese. The effect of the quantity of protein eaten upon xantho uric-acid excretion was also considered.

The influence of climatic factors, muscular work, and baths upon the excretion of water vapor through the skin, A. J. KALMANN (*Arch. Physiol.* [*Pflüger*], *112* (*1906*), *No. 11-12, pp. 561-599, pls. 2, fig. 1*).—From tests in which muscular work was a factor the conclusion was reached that it caused an increase in the amount of water vapor given off through the skin, which was proportional to the character and amount of the work and especially to the temperature of the surrounding air and the degree of moisture which it contained. Cooling the skin resulted in a marked decrease in the amount of water vapor given off through it.

Fatigue, F. S. LEE (*Jour. Amer. Med. Assoc.*, *46* (*1906*), *No. 20, pp. 1491-1500, figs. 5*).—A general discussion of the causes and relief of fatigue in which much of the literature of the subject is summarized. As the author points out fatigue and recovery are phenomena of metabolism and only the assimilation and detoxication of the fatigue substances contained in the tissues "that normally come with rest—and, best, rest with sleep—are capable of adequate restoration of working power."

Influence of age on the calcium content of the blood, C. DHÉRÉ and G. L. GRIMMÉ (*Compt. Rend. Soc. Biol.* [*Paris*], *60* (*1906*), *No. 22, pp. 1022, 1023*).—In dogs, the proportion of calcium in the blood decreased regularly as age increased. With rabbits the proportion varied greatly with individuals of the same age and did not appear to be directly proportional to the age. Generally speaking, the calcium content of rabbit blood was about double that of dog blood.

The physiology of taste, W. STERNBERG (*Geschmack und Geruch-Physiologische Untersuchungen über den Geschmackssinn. Berlin: J. Springer, 1906, pp. 150; rev. in Brit. Med. Jour., 1906, No. 2393, p. 1309*).—A summary and discussion of available data on the physiology of taste, methods of measuring taste, and related questions.

ANIMAL PRODUCTION.

The feeding of farm stock, F. W. TAYLOR (*New Hampshire Sta. Bul. 127, pp. 187-207*).—The composition and digestibility of feeding stuffs, feeding standards, palatability of rations, and related questions are discussed, tables of composition are given, and the computation of rations explained by examples.

"The economic feeding of stock should be the feeder's primary object.

"Economic feeding must go hand in hand with scientific feeding.

"The principles of scientific feeding have been carefully worked out by skilled investigators and feeders.

"The application of these scientific principles is a very simple process involving only the rules of common arithmetic.

"Every farmer can and should apply these principles in his everyday practice.

"A careful study of the market prices on feeds and an inspection of their guarantee tags will mean money in pocket to the farmer."

Steer feeding, J. J. VERNON and J. M. SCOTT (*New Mexico Sta. Bul. 57, pp. 13, pls. 2*).—Continuing earlier work (E. S. R., 16, p. 189), the comparative

value of alfalfa hay with and without grain was studied with 2 lots of 5 steers. On alfalfa hay ad libitum with about one-third of a full ration of wheat and bran 3:1 the average daily gain in 118 days was 1.86 lbs. per head and each pound of gain required 9.12 lbs. grain and 1.12 lbs. alfalfa hay. On alfalfa hay ad libitum without grain the average increase was 1.73 lbs. per head per day, 11 lbs. of hay being required per pound of gain. Reckoning alfalfa at $3.50 per ton a pound of gain cost 2.76 cts. on a ration containing grain and 1.92 cts. on hay only. The calculated returns per ton of alfalfa hay in the 2 cases were $7.38 and $8.36, respectively. "If we take an average of the 3 years' feeding tests we find that the lots receiving a grain ration made a slightly larger daily gain per 1,000 lbs. live weight than did the lots receiving alfalfa hay only. It required nearly 1 lb. more food for a pound of gain for those receiving alfalfa hay only than for the grain-fed lot. The cost of 1 pound of gain was higher when a grain ration was fed than when alfalfa was fed alone."

Feeding prickly pear to stock in Texas, D. Griffiths (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 91, pp. 23*).—This bulletin, which supplements Bulletin 74 of the Bureau of Plant Industry (E. S. R., 17, p. 65), contains notes on the forms of prickly pear and gives the results of feeding tests with cows and steers. The method of feeding this plant was that commonly employed upon ranches in southern Texas where the experiments were conducted.

In tests with two cows prickly pear was compared with sorghum hay. The complete data including weather observations are reported. "A full roughage ration of pear with a constant grain ration appears to yield fully as good results as a full roughage ration of sorghum hay. The records are really a little more favorable to the pear ration." The prickly pear ration including 12 lbs. of rice bran and 3 lbs. of cotton-seed meal cost 13.05 cts. per cow daily. This allowed for the labor and gasoline required in singeing the cactus. It is stated that prickly pear has been fed to a dairy herd for 2 to 4 months each year for 6 or 8 years with no complaint from customers which could in any way be attributed to pear feeding.

A lot of 27 steers was kept in a 4-acre feeding lot and fed chopped prickly pear with cotton-seed meal. The largest and most woody plants available were selected, chopped without singeing, and fed in troughs early in the morning and about the middle of the afternoon. The cotton-seed meal was sprinkled on the chopped prickly pear. The average daily gain in the 105 days of the test was 1.75 lbs. per head, 55.03 lbs. of prickly pear and 2.5 lbs. of cotton-seed meal, at a total cost of 3.48 cts., being required per pound of gain. When shipped to market the average shrinkage per steer was 88.5 lbs.

Notes on the prickly pear, E. A. Nobbs (*Agr. Jour. Cape Good Hope, 29 (1906), No. 5, pp. 637–642*).—In connection with a discussion of the spread of prickly pear in Cape Colony, the desirability of eradicating it, and related questions, the statement is made that in times of droughts singed prickly pear is used as a feeding stuff for farm animals.

On the whole, the author concludes, prickly pear is not a wholesome feeding stuff and is at best only a makeshift during a time of drought. The fruit, as pointed out, is used as human food and is also used in the manufacture of a distilled spirit.

A study of the metabolism and physiological effects of certain phosphorus compounds with milch cows, W. H. Jordan, E. B. Hart, and A. J. Patten (*New York State Sta. Tech. Bul. 1, pp. 59; Amer. Jour. Physiol., 16 (1906), No. 2, pp. 268–313*).—The experiments reported were undertaken with a view to ascertaining the comparative value of different phosphorus compounds occurring in feeding stuffs, particularly phytin, a phosphorus compound occurring in bran in which an organic radical is coupled with calcium, magnesium,

and potassium. "Phytin is widely distributed in nature, and has been found in the seeds of red fir, pumpkin, peas, beans, white and yellow lupines, potatoes, and wheat."

Phytin may be completely or nearly removed from wheat bran by washing with water, but more easily by allowing the bran to undergo a slight fermentation, followed by leaching with water.

The experiments were made with 2 cows, and the income and outgo of nitrogen and phosphorus were studied on high phosphorus rations made up of oat straw, hominy or rice meal, whole-wheat bran, and wheat gluten, and low phosphorus rations in which rice, wheat gluten, and oat straw were combined with washed wheat bran. "Through the use of the wheat gluten, which contained from 70 to 75 per cent of protein, it was easy to regulate the protein supply so as to make it fairly uniform in the rations compared."

Quotations from the authors' summary and discussion follow: "The amount of outgoing phosphorus rose and fell with the quantity supplied in the food, though within narrow limits. When the phosphorus supply was abundant there was a storage of this element in the bodies of the animals, but during prolonged periods in which the supply of phosphorus was deficient there was withdrawn from the body store about 10 gm. daily in several periods.

"Through catabolic changes the phosphorus of the phytin and that of the unused digested nucleo bodies was reduced to inorganic combinations, and was excreted chiefly in the feces, though to a small extent in the urine. . . .

"The rise and fall in the amounts of outgoing phosphorus compounds occurred almost wholly with the inorganic salts found in the egesta. The organic phosphorus bodies of the egesta were but little affected, if at all, by the proportions of phosphorus compounds in the food. Variations in the phosphorus supply appeared not to modify the appropriation of this element by the milk.

"No relation whatever appears to exist between nitrogen excretion and phosphorus excretion.

"It is shown without question that the physiological effect of the two rations, due to the withdrawal from the bran of such compounds as were soluble in slightly acidulated water, differed to a marked degree. With the washed bran ration as compared with the one containing the unwashed bran, the following differences were observed:

"(a) Drier and much firmer feces with the washed bran ration, accompanied by a constipated condition, requiring in some cases the use of a purgative.

"(b) A marked disturbance of appetite in [one] experiment . . . when a sudden change was made from the washed bran ration to the one containing the unwashed bran, indicating some specific physiological influence of the compound or compounds removed from the bran by leaching.

"(c) A greatly reduced flow of urine followed a change from the unwashed bran to the washed bran ration, the reverse taking place when a reverse change was made.

"(d) An increase in the flow of milk consequent upon the withdrawal from the ration of the phytin and other water-soluble constituents of bran.

"(e) A reduction, sometimes large, in the percentage of fat in the milk consequent upon the withdrawal from the ration of phytin and other water-soluble constituents of bran.

"(f) A decreased production of butter fat during the period the washed bran ration was fed, notwithstanding a somewhat increased flow of milk.

"(g) The entire cessation of the œstrum period with cow 1 and a temporary disturbance of this period with cow 2. . . .

"The difference in effect of the two rations may be due to the larger supply of phosphorus in one ration without reference to the form of combination.

"The compound known as phytin may have specific physiological influences in several directions.

"The withdrawal from the ration of the basic compounds with which phosphorus is associated in the compound phytin may explain wholly or in part the peculiar physiological influences observed."

The laxative effects observed with phytin suggested that such conditions when noted with whole-wheat products can be assigned to this constituent rather than to their mechanical condition. With this point in view, the phosphorus content was determined in a number of milling products ground from the same lot of wheat and found to be as follows: Whole wheat 0.378 per cent, bran 1.280 per cent, middlings (ships) 0.857 per cent, germ 0.765 per cent, straight flour 0.089 per cent, first break flour 0.089 per cent, second break flour 0.088 per cent, third break flour 0.088 per cent, first middlings 0.071 per cent, second middlings 0.079 per cent, third middlings 0.091 per cent, germ roll flour 0.074 per cent, tailings or last roll 0.135 per cent, tailings (reel) 0.134 per cent, bran duster flour 0.196 per cent, and low-grade flour 0.166 per cent.

The authors note that middlings is the millers' term for fine flours.

"It is evident, as is well known, that the phosphorus compounds of the wheat kernel are found mainly in the outer coatings and germ from which are derived the bran and middlings. As the bran phosphorus is mostly contained in the compound phytin, it is self-evident that this substance exists in much larger proportion in the whole wheat bread than in fine flour. These statements are offered as suggesting a problem for further study."

Fattening pigs on corn and tankage, E. A. BURNETT (*Nebraska Sta. Bul. 94, pp. 12*).—The value of animal by-products as feeding stuffs and the effect of different rations on the strength of bones were studied.

A lot of 6 pigs fed soaked corn for 8 weeks made an average daily gain of 1.16 lbs. per head at a cost of 3.76 cts. per pound, and required 5.3 lbs. of feed per pound of gain. A similar lot of 7 pigs fed soaked corn with 5 per cent tankage made a daily gain of 1.44 lbs. per head at a cost of 3.55 cts. per pound and required 4.58 lbs. of feed per pound of gain. Similar values for a lot of 6 pigs fed soaked corn and 10 per cent tankage for 6 weeks were 1.3 lbs., 4.32 cts., and 5.16 lbs.

In a second test made with 3 lots of 10 lighter pigs and covering 8 weeks, the average daily gain on soaked corn was 1.26 lbs., on the smaller tankage ration 1.51 lbs., and on the heavier tankage ration 1.53 lbs. per head per day, the cost of a pound of gain in the 3 cases being 3.04, 2.88, and 3.09 cts., and the feed required per pound of gain 4.16, 3.71, and 3.66. lbs.

In a third test in which shelled corn was used 8 pigs fed corn and shorts 4:1 for 8 weeks gained 0.75 lb. per head per day, the feed required per pound of gain being 4.58 lbs. and the cost of a pound of gain 3.35 cts. The gains were the same on corn with 5 per cent tankage and on corn with 10 per cent tankage, namely, 1.03 lbs. per head per day, the feed required per pound of gain being 3.45 lbs. and 3.49 lbs., respectively, and the cost of a pound of gain 2.67 and 2.93 cts.

In the first of the tests some green sorghum was fed and in the other 2 tests the pigs were pastured on alfalfa, but no account was taken of the green feed eaten.

"The experiments with relatively mature animals have all shown that the addition of 5 per cent tankage to the ration produced cheaper gains than when 10 per cent tankage was used. With young pigs the gains were made on smaller amounts of food when the larger amount of tankage was added to the ration, but

the high cost of the tankage has made the smaller amount of tankage more profitable.

"A notable advantage in the feeding of tankage is seen in the more rapid gains made by the hogs and the consequent shortening of the feeding period.

"Another argument for tankage is that it is a concentrated protein food. Only a small amount is required to produce the result desired.

"In all the experiments made at this station, the hogs fed tankage consumed more feed, made larger gains, and were not easily put off feed, while the hogs fed straight shelled corn were easily thrown off feed after the first 6 weeks, consumed less feed, and made slower gains. From the limited test made we advise adding the tankage to the soaked corn just before feeding, rather than mixing with the corn before soaking and allowing the tankage time to soak and possibly become rancid before feeding."

In the test in which the effect of feed on the strength of bones in growing pigs was studied the rations fed the 4 lots, each containing 9 pigs, for 12 weeks consisted of soaked corn alone and with 10 per cent tankage, 10 per cent ground bone, and 25 per cent shorts, respectively. For the succeeding 4 weeks 10 per cent of the corn was replaced by alfalfa hay in each ration and then, as the alfalfa hay was not eaten readily, the unthrifty pigs (1 from each lot) were discarded and the original ration was resumed for 5 weeks. At the beginning of the test the weight of the pigs ranged from 57 to 66 lbs. on an average. The smallest gain, 114 lbs., was noted with the lot fed the corn ration and the greatest gain, 164 lbs. per pig, with the lot fed ground bone. Three pigs in each lot were slaughtered and the strength of the leg bones determined with a testing machine. Considering the average for 2 bones in each leg, the bones were markedly stronger in the case of the pigs fed the animal by-products, 1,081 lbs. (the highest value) being required to cause breaking in the case of the ground-bone fed lot as compared with 714 lbs. (the lowest value) in the case of the corn-fed lot. Similar results were noted with the fore leg radius bone and the lower hind leg tibia.

After continuing the feeding for 1 weeks 4 pigs in each lot were killed and the breaking tests repeated. As before, the strongest bones were noted with the lot which had received animal by-products, the average values (8 bones) ranging from 434 lbs. with the corn-fed lot to 1,057 lbs. with the lot fed tankage.

"It is apparent from these results that the feeding of tankage or ground bone to young growing pigs produces a very marked effect on the strength of bone when compared with a corn ration and that its influence is still marked when compared with corn and shorts on alfalfa pasture."

The test is regarded as preliminary and final conclusions are not drawn.

Analyses of commercial feeding stuffs, J. E. Halligan (*Louisiana Stas. Bul. 88, pp. 61*).—In carrying out the provisions of the State feeding-stuff law 1,815 samples were analyzed, including cotton-seed meal, rice bran, molasses feeds, corn and oat feeds, wheat bran and mixed feed, brewers' grains, commercial and proprietary feeds, and beef scraps and similar poultry feeds. Special fiber determinations were also made in 123 samples of feeding stuffs.

"Good wheat bran is a scarce article in Louisiana. Some of these brans are adulterated with oat offal, and contain screenings. . . .

"Many of the mixed feeds sold in this State are adulterated with ground corncobs. These feeds came up to their guarantee in most cases, but the consumer in buying these feeds pays fully as much as for the genuine article. A true mixed feed, under this head, is composed of bran and middlings in varying proportions. The consumer should demand a mixed feed carrying at least 16.50 per cent protein.

"There have been very few samples of . . . [condimental] feeds received in this laboratory. These feeds are a mixture of sulphur, salt, saltpeter, epsom salts, Glauber's salts, sodium bicarbonate, fenugreek seeds, fennel seeds, charcoal, red and black peppers, ground bone, venetian red, and anise. This class of feeds generaly carry attractive names, and the manufacturers make great claims regarding their curative properties. These feeds are too expensive for the economical feeder.

"If your animals are in good health they need no condition powders or tonics, and if they are sick it is cheaper to consult a veterinarian."

Commercial feeding stuffs in Pennsylvania in 1905, F. D. Fuller (*Penn. Dept. Agr. Bul. 145, pp. 51*).—The 339 samples of feeding stuffs examined under the provisions of the State feeding-stuff law included cotton-seed meal, linseed meals, flaxseed meals, distillery and brewery by-products, gluten meal and other corn by-products, corn meal, corn-meal feed, corn flour, low-grade wheat flour, wheat middlings, wheat bran, bran and middlings, oat by-products, mixed and proprietary feeds, proprietary poultry feeds, barley, barley feeds, and dried sugar-beet pulp.

Of the wheat offals examined, 11 were deficient in fat, 13 in protein, and 22 in both protein and fat. Six feeds were found to be adulterated, namely, "wheat bran with rice hulls, wheat bran with corncob, 'chop' (corn and light oats) with coffee hulls, 2 samples of corn and oats chop, and 1 sample of corn, oats, and barley with oat hulls. Wheat offals were inferior in quality, which was due largely to climatic conditions.

"The oat feeds on the market contain a large proportion of oat hulls. There are on the market, however, a large variety of feeding stuffs of good quality from which the farmer should have no difficulty in choosing those best adapted to his need. As long as the farmer can raise plenty of corn, hay, and oats he can not afford to purchase any feeding stuff containing less than 14 per cent of protein."

The poisonous properties of peanut-oil cake, E. Krüger (*Chem. Ztg., 30 (1906), No. 81, p. 999*).—Brief notes are given regarding a case of poisoning attributed to ground peanut-oil cake. In the author's opinion, this was due to the accidental presence of castor bean, to decomposition, or to some similar cause, as investigations failed to reveal toxic properties and other portions of the same consignment of meal were apparently harmless.

Purin bodies in the urine of pigs, cattle, and horses, A. Schittenheim and G. Bendix (*Ztschr. Physiol. Chem., 48 (1906), No. 2, pp. 140–144*).—The amount of purin bases in pigs' urine is greater than that of uric acid and increases markedly in hunger. In cattle the ratio is about the same as with man, namely, considerable uric acid and little of the basic bodies. With horses, according to the author, the amount of purin bases is 7 or 8 times as great as the amount of uric acid. Apparently the purin metabolism of different kinds of animals varies markedly.

The effect of raw meat on young animals, C. Richet (*Compt. Rend. Acad. Sci. [Paris], 142 (1906), No. 9, pp. 522–524*).—The experiments were made with young dogs and covered 6 months. In 3 of the tests cooked meat alternated in 5-day periods with porridge (made of rice, milk, and sugar), with raw meat, and with cheese. In the 4 remaining tests a diet of cooked meat, raw meat, porridge, and cheese alternated in 5-day periods, with fasting periods of like duration. In the feeding periods in which the diet varied the dogs remained in good condition. When fasting during each alternate period the most satisfactory results were obtained on raw meat. The dogs lost 10 per cent of their weight in 3 months, then made good the loss and practically maintained a con-

stant weight. On cooked meat the animals remained in good health, but lost 20 per cent in weight. The dogs fed the porridge of rice, milk, and sugar all died before the conclusion of the experimental period, as did 2 of those fed cheese.

In the author's opinion, the experiments demonstrated the great value of raw meat, especially as an aid to the recuperative powers, and he believes that this is dependent not alone upon the quantity of protein present, but upon some quality which is lessened by cooking. The experiments as a whole were undertaken as an outcome of the author's interest in the value of raw meat in the treatment of tuberculosis.

Report on the poultry industry in America, E. BROWN (*London: Nat. Poultry Organ. Soc., 1906, pp. VIII+124, pls. 8, fig. 1*).—In this report the author discusses the methods of poultry raising in Canada and the eastern United States, systems of feeding, incubation and rearing, egg production, table poultry, duck farming, turkey raising, marketing of eggs and poultry, inspection work at the agricultural colleges and farmers' institutes, experiment station work pertaining to poultry, government assistance in poultry raising, and related questions. The data presented are the result of a special tour of inspection. Some of the conclusions drawn follow:

"American experience proves the importance of securing immunity from taint in the soil, either by the adoption of double yards to permanent houses, with use and cultivation of the ground in alternation, or by systematic removal to fresh ground, thus confirming our own practice.

"Owing to different climatic conditions, the portable house system so largely used in the United Kingdom is most suited to farm operations in this country [Great Britain], and should be maintained where poultry are a part of the ordinary stock of the farm. . . .

"American experience confirms our own as to the profitable nature of duck farming as a special business on a large scale. . . .

"The importance of a thorough training, theoretical and practical, in poultry keeping is more fully recognized in America than with us, but the instruction is specialized and not so general, and facilities for instruction are eagerly sought for by those intending to take up this work.

"The experiment stations in America are most complete, well maintained and equipped, and by co-ordination considerable results have been achieved, which example should without delay be followed in Britain."

Poultry in Pennsylvania, T. E. ORR (*Penn. Dept. Agr. Bul. 143, pp. 36, pls. 3, fig. 1*).—On the basis of personal experience the author discusses the feeding and care of poultry, artificial incubation, the raising of ducks, turkeys, and geese on the farm, poultry diseases, and related questions.

A combination of fruit growing and poultry raising is especially recommended. "Locate your poultry houses if possible so that the runs will be in an orchard. The fowls will destroy thousands of harmful insects, thus greatly benefiting the trees and increasing the prospects for fruit, and the fowls will gain great comfort and benefit by the protecting shade of the trees. Plum trees and cherry trees are especially benefited by the presence of the fowls about their roots. Peach trees will grow most rapidly and soonest give an abundant shade."

Poultry notes; guinea fowls; bananas for chickens (*Jour. Jamaica Agr. Soc., 10 (1906), No. 8, pp. 308, 309*).—Brief notes are given regarding raising guinea fowls or "Jamaica pheasants" and other poultry under local conditions. Ripe bananas are recommended as a good morning food for fowls, but boiled green bananas are not regarded as conducive to egg production.

Poultry notes. Bananas as feed (*Jour. Jamaica Agr. Soc., 10 (1906), No.*

10, pp. 401, 402).—Brief statements are made regarding the use of local feeding stuffs for poultry. Bran with boiled green bananas or ripe bananas and some green corn are among some of the mixtures suggested as suitable for use in morning rations.

Regulating the egg trade, K. Borchmann (*Ztschr. Fleisch u. Milchhyg., 17 (1906), No. 1, pp. 3–11*).—The defects in the present system of marketing eggs in Berlin are pointed out and reforms suggested.

DAIRY FARMING—DAIRYING—AGROTECHNY.

A comparison of alfalfa meal and wheat bran for dairy cows, T. I. Mairs (*Pennsylvania Sta. Bul. 80, pp. 10*).—Alfalfa meal or finely ground alfalfa hay was compared with wheat bran, pound for pound. The test was made with 10 cows divided into two equal lots. The feeding covered 4 periods of 3 weeks each. The wheat bran was fed to both lots during the first and fourth periods, to lot 2 during the second period, and to lot 1 during the third period. The alfalfa meal was fed to lot 1 during the second period and to lot 2 during the third period. All other conditions were uniform for both lots.

The protein content of the alfalfa meal was 15.48 per cent and of the wheat bran 16.95 per cent. The alfalfa meal was eaten less readily than the wheat bran and produced a decrease in the yield of milk. With alfalfa meal at $23 per ton and wheat bran at $20 per ton, the prices prevailing in central Pennsylvania, the cost of grain for 100 lbs. of milk when the cows were fed alfalfa meal was 47.1 cts. and when fed wheat bran 45.3 cts. With wheat bran at $20 per ton the alfalfa meal was apparently worth only $21.28 per ton.

At present market price, the author, therefore, does not recommend alfalfa meal as a substitute for wheat bran as a feed for dairy cows.

Investigations on the effect of nutritive and condimental substances upon milk secretion, F. Merkel (*Inaug. Diss., Leipsic, 1906; abs. in Milchw. Zentbl., 2 (1906), No. 11, pp. 495–500*).—In experiments with 15 cows the feeding of an excessively rich ration immediately after calving not only failed to increase milk production but tended to lessen it. The live weight of the animal, however, was favorably affected. When the same ration was fed later during the lactation period milk secretion was increased.

Fennel as a condimental or stimulating substance exerted a favorable influence on milk secretion only when given with heavy rations. Under such conditions, however, there was a decrease in the live weight of the animal.

Comparative experiments on the feeding value of sugar and proteids for the production of milk and milk fat, E. A. Bogdanov (*Izv. Moscov. Selsk. Khoz. Inst. (Ann. Inst. Agron. Moscou), 12 (1906), No. 3, pp. 257–307*).—This work is a direct continuation of that previously noted (E. S. R., 17, p. 71). Four experiments were conducted each including 4 cows and continuing for 3 or 4 periods of 10 days each. The general conclusion drawn is that the feeding of sugar is without particular value. In individual instances, however, sugar increased milk production. It was only in the case of rich rations with a narrow nutritive ratio that the feeding of sugar was economical and it was thought that here the same results might have been secured with a much cheaper material.

Seasonal variations in the composition of cows' milk, H. C. Sherman (*Jour. Amer. Chem. Soc., 28 (1906), No. 12, pp. 1719–1723*).—Average monthly analyses are given of the milk of a herd of about 600 cows in Westchester County, New York. Five years' results are summarized and compared with similar data reported by H. D. Richmond. The cows were either registered or

grade Jerseys and were selected and managed with a view to the production of milk rich in fat. The following table gives the average composition of the afternoon milk from September, 1900, to August, 1905:

Average composition of cow's milk by month.

Month.	Fat.	Solids-not-fat.	Protein.	Milk sugar.	Ash.	Total solids.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
January	5.57	9.37	3.80	4.82	0.76	14.94
February	5.52	9.39	3.77	4.86	.76	14.91
March	5.46	9.27	3.66	4.86	.75	14.73
April	5.42	9.18	3.60	4.84	.74	14.60
May	5.40	9.17	3.57	4.86	.74	14.57
June	5.53	9.11	3.57	4.79	.75	14.64
July	5.24	8.96	3.49	4.73	.74	14.20
August	5.26	9.02	3.53	4.74	.74	14.28
September	5.33	9.15	3.62	4.79	.74	14.48
October	5.36	9.26	3.70	4.81	.75	14.62
November	5.38	9.35	3.80	4.81	.75	14.73
December	5.52	9.43	3.85	4.82	.76	14.95
Average	5.42	9.22	3.66	4.81	.75	14.64

As compared with the data obtained by Richmond in England, the author's results show in general similar seasonal variations in fat and solids-not-fat. The fat, however, varied less in proportion to the amount present and reached a maximum somewhat later in the winter, while the solids-not-fat varied more and reached a maximum about a month earlier.

Daily variations in milk, M. Siegfeld (*Molk. Ztg., 20 (1906), No. 44, pp. 1239–1241*).—This gives the results of analyses of the milk of 8 herds during 1 year. The highest and lowest fat content for each herd during the year was as follows: 1, 3.80 and 2.15 per cent; 2, 4.75 and 2.20 per cent; 3, 4.30 and 2.75 per cent; 4, 4.75 and 2.25 per cent; 5, 4.50 and 2.55 per cent; 6, 4.00 and 2.70 per cent; 7, 5.05 and 2.50 per cent; and 8, 4.15 and 2.60 per cent. The causes of variation are discussed.

Fat content of ass's milk, Wagner (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 11, pp. 658, 659*).—During the period from 1902 to 1906 analyses were made of 392 samples, the results showing a range in fat content from 0 to 0.7 per cent with an average of 0.125 per cent.

Comparative study of the more important lactoses, G. Bonamartini (*Rev. Gén. Lait, 6 (1906), No. 1, pp. 10–18*).—Preparations of lactose were made from the milk of the cow, ass, goat, and sheep, and also from human milk, and compared as regards water of crystallization, reducing power, polarization, and form of crystals. These means failed to show any difference in the preparations from the different sources.

Leucocyte content of milk drawn from apparently healthy animals, H. L. Russell and C. Hoffman (*Jour. Amer. Med. Assoc., 47 (1906), No. 25, p. 2110*).—This is a brief abstract of a paper presented before the thirty-fourth annual meeting of the American Public Health Association held in Mexico City, Mexico, December 3–7, 1906.

According to the authors, sufficient data have not yet been secured on the leucocyte content of milk to warrant the formulation of a scientific standard for judging milk as to the presence of pus. They find wide variations in the leucocyte content of milk from cows having no discoverable udder lesion nor previous history of garget. The number is often in excess of present standards. The authors also find that a leucocytosis in animals subjected to changes in environment may manifest itself in the leucocyte content of the milk.

A milk epidemic of diphtheria associated with an udder disease of cows, A. ASHBY (*Pub. Health [London], 19 (1906), No. 3, pp. 145–160, figs. 6*).—Investigations of a severe epidemic of diphtheria in the villages of Twyford and Ruscombe in Berkshire in 1904 indicated that the disease was spread by milk and that this became infected from ulcers on the teats of cows.

Report on an investigation of an outbreak of typhoid fever at Kenton, Ohio, E. G. HORTON (*Ohio Sanit. Bul., 10 (1906), No. 7–12, pp. 142–148*).—The data secured indicated that the outbreak was due mainly to infected milk.

The National Creamery Buttermakers' Association, 1906 (*Nat. Cream. Buttermakers' Assoc. Rpt., 1906, pp. 227, figs. 2*).—This contains a number of addresses on subjects such as the preparation and value of starters, pasteurization of cream for butter making, the creamery overrun, churning of fresh cream, etc., with a discussion following each paper.

In addition to the proceedings of the National Creamery Buttermakers' Association this report includes an account of the national dairy farmers' convention which was held about the same time. Some of the subjects discussed at the latter meeting were science and profit in dairying, the breeding and handling of dairy cows, economical feeding for milk production, profitable dairy farming, the hand separator problem, and the milk and cream exhibit at the national dairy show.

The preparation of dry cultures, A. VON ADELLOFF (*Milchw. Zentbl., 2 (1906), No. 11, pp. 489–492*). Tests were made of magnesia, gypsum, milk sugar, and potato flour for absorbing milk cultures of lactic-acid bacteria for use in butter making. A culture was also prepared by liquefying a gelatin culture of lactic-acid bacteria by heating to 40° C., adding milk sugar, drying the mixture, and pulverizing.

The gypsum, magnesia, and potato flour were considered unsuitable for this purpose. The author believes that a dry culture should be prepared from a milk culture, and that the absorbent material should be soluble and indifferent in character.

Improving the keeping qualities of butter by means of hydrogen peroxid, A. HESSEGÜSTROW (*Milchw. Zentbl., 2 (1906), No. 11, pp. 487–489*).—Butter was made from cream which had been treated with hydrogen peroxid according to the method of Budde. The results of the three tests made indicated that this method improved the keeping quality of the butter. The author, however, does not wish to draw positive conclusions from such limited data.

Contribution to the knowledge of casein and coagulation with rennet, S. SCHMIDT-NIELSEN (*Upsala Läkareför. Förhandl., n. ser., 11 (1906), Sup., pp. 26*).—According to the experimental results obtained, pure neutral sodium caseinate and sodium paracaseinate in 2 per cent solutions are not precipitated by pure sodium chlorid, but are completely precipitated by common salt which contains 0.4 per cent of calcium. The quantity of calcium required for this precipitation is for the casein 6.5 per cent and for the paracasein 3 per cent. This is, however, in excess of the amounts actually combining with the casein and paracasein. The calcium may be replaced by barium or magnesium in quantities three times as large.

It was found that the formation of so-called whey albumin stands in close relation to the formation of paracasein, though it is not yet clear in what way the albumin is formed. In addition to the enzym bringing about the changes resulting in paracasein and whey albumin, it is possible that there is also present in the rennet solution a second proteolytic enzym.

Milk or calcium casein solution decidedly alkaline to litmus is coagulated with rennet. During coagulation the reaction tends to become acid. It is

considered clear that coagulation with rennet can take place in the absence of free H ions. The number of OH ions present, however, must not be so great as to give a reaction with phenolphthalein.

The ripening of Edam cheese, F. W. J. Boekhout and J. J. Ott de Vries (*Rev. Gén. Lait, 6 (1906), No. 1, pp. 1–10*).—According to the results of the present and earlier investigations (E. S. R., 17, p. 589) lactic-acid bacteria develop rapidly in fresh Edam cheese and destroy all the lactose. These organisms then become latent and other bacteria develop. The changes thus produced are not believed to be the sole cause of the odor and taste of this cheese.

During milking and subsequent handling milk becomes greatly contaminated with bacteria, among which are many liquefying forms. These are unable to subsist in the acid medium resulting from the lactic fermentation in the cheese, but it is argued that the proteolytic enzyms previously produced by the liquefying bacteria remain unchanged and bring about changes in the cheese resulting in the formation of the characteristic odor and taste. Lactic-acid bacteria and proteolytic enzyms are therefore considered the ripening agents.

Contribution to the bacterial flora of Edam cheese, J. Raamot (*Dissertation, Königsberg, 1906; abs. in Milchw. Zentbl., 2 (1906), No. 11, pp. 509, 510*).—Bacteriological examinations were made of various grades of Edam cheese. The better the cheese the more lactic-acid bacteria were found. The conclusion is therefore drawn that lactic-acid bacteria are the most important agents in the ripening of this cheese.

Fermentation organisms, A. Klöcker (*Die Gärungsorganismen in der Theorie und Praxis der Alkoholgärungsgewerbe. Stuttgart: Max Waag, 1906, 2. ed., pp. XVI+392, figs. 157*).—An English translation of the first edition of this treatise was noted in E. S. R., 15, p. 450.

Annual report on fermentative organisms, A. Koch (*Jahresber. Gärungs-Organismen, 13 (1902), pp. VIII+672*).—This report for 1902 recently published contains abstracts and titles of articles relating to the different fermentations classified under (1) text-books and reviews, (2) methods and apparatus, (3) morphology, bacteria, and yeasts, (4) general physiology of bacteria, (5) special fermentations, and (6) enzyms.

Technology of fats and oils, G. Hefter (*Technologie der Fette und Öle. Berlin: J. Springer, 1906, pp. XVII+741, pls. 10, figs. 346*).—This is the first part of a handbook on the production and utilization of fats, oils, and waxes of vegetable and animal origin.

VETERINARY MEDICINE.

Text-book of comparative general pathology, T. Kitt, trans. by W. W. Cadbury (*Chicago: W. T. Keener & Co., 1906, pp. XIII+471, pls. 4, figs. 131*).—The veterinary literature in the English language has been in need of a general text-book of pathology treated from the veterinary standpoint rather than from that of human medicine. The translation makes this work available to veterinary students in America and England, and must, therefore, be of considerable influence in furthering the present tendency toward the improvement of veterinary education.

The text contains a discussion of the history of pathology, predisposition toward disease, congenital and hereditary disease, and the causes of disease together with a thorough account of pathological processes as observed in disturbances of the circulation, metabolism, and the progress of infectious diseases.

A number of new illustrations have been added to the text to show various features of microscopical pathology.

While the general pathological processes are very similar in man and animals the appearance of the lesions may differ considerably in different animals and the discussion of these matters can, therefore, be much more specific in a text-book of this sort than one which attempts to include human as well as animal pathology.

Report of the Minnesota State Live Stock Sanitary Board, 1906, S. H. WARD ET AL. (*Ann. Rpt. Minn. Live Stock Sanit. Bd., 3 (1906), pp. 108*).—During the year under report 13,707 cattle were tested and 1,438 were killed as tuberculous. This is equal to 10 per cent, but it is believed that the percentage would not be so high if all of the animals of the State were tested. Similarly during the year 3,322 horses were tested with mallein and of this number 606 reacted and were killed. An indemnity is paid to the owners for animals killed by the State authorities.

It is stated that more stringent milk and meat inspection laws are required for the proper regulation of traffic in these food materials in the State. Of the cattle imported into Minnesota from other States nearly 4 per cent were found to be tuberculous and were condemned. It is also noted that tuberculosis is becoming more frequent in hogs.

Detailed reports were made on the laboratory work undertaken by the State board on mange, necrotic stomatitis, rabies, hemorrhagic septicemia, swamp fever, and dourine.

Division of animal industry, V. A. NORGAARD (*Rpt. Bd. Comrs. Agr. and Forestry Hawaii, 2 (1905), pp. 167–228*).—Glanders prevails to a great extent in Honolulu and vicinity and the mallein test has been generally applied for controlling it. The spread of the disease is partly due to the use of public watering troughs for glanderous horses.

It has been observed in Hawaii that the horn fly attacks scabby sheep, causing serious irritation of the scabby areas and sometimes annoying the sheep by attacking other parts of the body not heavily covered with wool. It is possible that the horn fly may carry sheep scab.

Copies are included of the rules promulgated by the governor and board of commissioners regarding animal industry in Hawaii. Considerable attention has been given to the improvement of animal industry in the islands and to a study of the conditions which have led to failure in certain instances. It is suggested that the soils and forage plants of Hawaii are somewhat lacking in lime, and lime or bone meal is, therefore, recommended as an addition to the rations. Osteomalacia has been observed quite frequently and appears to be due to the absence of lime.

Report of the cattle sanitary board of New Mexico, 1904–5, W. C. BARNES (*Ann. Rpts. Cattle Sanit. Bd. N. Mex., 1904–5, pp. 30*).—Considerable work has been done in dipping cattle for the control of mange and the destruction of cattle ticks. The results from this work are promising. Statistical information is furnished regarding the health of domestic animals and the shipment of cattle, horses, mules, and hides.

Report of the veterinary director general, J. G. RUTHERFORD (*Rpt. Vet. Dir. Canada, 1905, pp. 232, pls. 12*).—This report covers a period from November 1, 1904, to March 31, 1906, and is largely occupied with a discussion of tuberculosis, glanders, dourine, cattle mange, rabies, hepatic cirrhosis, and meat inspection.

Hog cholera is practically under control in the regions where it prevails. According to reports received by various inspectors, glanders exists to a serious extent in most parts of the Dominion. The present system of killing all

animals affected with the disease whether they show clinical symptoms or not will probably reduce the extent of glanders.

An extensive series of feeding experiments was carried on in Antigonish during which it was clearly shown that Pictou cattle disease or hepatic cirrhosis is caused by eating *Senecio jacobæa*. Before this fact was demonstrated, the disease was considered infectious and an indemnity was paid to the owners of condemned animals.

A number of outbreaks of rabies took place and required the attention of the veterinary officers. Notes are also given in the reports of the numerous inspectors from different parts of the Dominion on the health of animals in their localities and the prevalence of common diseases.

Report of the veterinary service in the Kingdom of Saxony for 1905 (*Ber. Veterinärw. Königr. Sachsen, 50 (1905), pp. 419*).—As is customary in these reports the organization of the veterinary service is given, followed by an elaborate account of the general status of the health of animals and special reports on diseases, medicines, dietetics, cases of poisoning, the live-stock industry, veterinary police work, cattle breeding, and goat raising.

Statistical data are presented on the number and distribution of inspectors and freibanks in the Kingdom of Saxony, the number of animals slaughtered and inspected during the year, and the cause of condemnation of inspected animals.

The organization and function of the police and veterinary service in the kingdom (*Organizzazione e Funzionamento dei Servizi di Vigilanza e Assistenza Zooiatrica nel Regno. Rome: Min. Int., 1906, pp. 302*).—In the present report a general discussion is presented of the principles which lie at the foundation of veterinary police and similar control work in the prevention of the spread of animal diseases. Such veterinary work may be organized under government supervision or may be of a communal or cooperative nature. Extensive tables are given showing the imports and exports in animal products from 1902 to 1905.

The larger part of the volume is occupied with a discussion of the present status of the important animal diseases in Italy, including foot-and-mouth disease, infectious swine diseases, anthrax, blackleg, glanders, contagious agalactia, rabies, tuberculosis, etc.

Report of proceedings under the diseases of animals acts for the year 1905 (*Dept. Agr. and Tech. Instr. Ireland, Rpt. Diseases Anim., 1905, pp. 112, pls. 3*).—A brief summary is presented of the present status of legislation regarding contagious diseases in Ireland with especial reference to anthrax, sheep scab, hog cholera, glanders, parasitic mange, and epizootic lymphangitis. A detailed report is given by M. Hedley on hog cholera and other serious animal diseases in Ireland, and by D. S. Prentice on the transportation of animals. On the whole, hog cholera has diminished greatly in prevalence during the past few years; rabies was not observed during 1905; glanders presented no serious problems; and parasitic mange occurred in 169 outbreaks. Copies are given of all orders and circulars which have been issued regarding the control of animal diseases in Ireland.

Report of the veterinary surgeon to the corporation of the city of Glasgow for 1904–5, A. M. Trotter (*Rpt. Vet. Surg. Glasgow, 1904–5, pp. 41*).—The present detective system of inspecting meat in Glasgow has certain disadvantages and is not effective in preventing unsuitable meat from coming into the market. The meat inspector's time is too much occupied in this system in running about from place to place inspecting a few carcasses which may be delivered by farmers or dealers to butchers, or even directly to consumers. A

change of plan is recommended, since the author believes that a preventive system would be more effective in securing the inspection of all meat at the point of production, and would save the time of the meat inspector for more important work.

The results of meat inspection in Glasgow for the years 1904–5 are presented in a tabular form. Particular attention is given to tuberculosis, anthrax, and the inspection of milch cows.

Veterinary service and meat inspection for 1904 (*Norges Off. Statis., 5. ser., 1904, No. 15, pp. VIII+287*).—As in previous years the present report on veterinary service and meat inspection in Norway contains a general account of the health of animals in various parts of Norway with particular reference to the appearance and distribution of anthrax, catarrhal fever, blackleg, swine erysipelas, tuberculosis, abortion, and milk fever. The distribution of these diseases in different parts of the country is shown in a series of tables.

Copies are given of the meat inspection regulations which are at present in force in Norway.

The epitome of cattle inspectors' returns (*Rhodesian Agr. Jour., 3 (1906), No. 6, pp. 636–642, pl. 1*).—In these returns particular attention is given to an account of the conditions in various parts of Rhodesia with reference to rabies, contagious abortion, glanders, African coast fever, and horse sickness.

Results obtained in the field of cattle diseases, F. MARKIEL (*Tierärztl. Zentbl., 29 (1906), No. 28, pp. 441–454*).—This article contains a brief summary of recent veterinary investigation and the results obtained in the control of sterility, metritis, mammitis, and actinomycosis.

Prophylaxis of contagious diseases of cattle, J. LIGNIÈRES (*Bol. Min. Agr. [Buenos Ayres], 5 (1906), No. 3, pp. 363–383, figs. 12*).—A brief statement is made of results obtained by the use of vaccine in controlling anthrax, blackleg, and Texas fever. Directions are also given for the destruction of rats and for the use of tuberculin and mallein.

Notifiable diseases under the milk and dairy supervision act, 1905, S. S. CAMERON (*Jour. Dept. Agr. Victoria, 4 (1906), No. 8, pp. 481–489, figs. 2*).—A discussion is presented of the symptoms and means of preventing accidental and contagious abortion and contagious mammitis in cows. For contagious abortion, the author recommends the use of antiseptic washes containing carbolic acid, creolin, lysol, or corrosive sublimate. The best results in the treatment of contagious mammitis were obtained from the injection of a solution of boracic acid at the rate of 1 part to 20 parts of warm water.

Tuberculous infection and the resistance of the organism to the disease, A. CALMETTE (*Rev. Hyg. et Pol. Sanit., 28 (1906), No. 8, pp. 641–660*).—The author admits the existence of three specifically different forms of tubercle bacilli in cold-blooded animals, birds, and mammals, respectively. The morphological differences, however, do not preclude the transference of these bacteria from one group of animals to another.

The conclusion is reached as a result of the study of this problem that animals and man are usually infected with tuberculosis through the alimentary tract. The necessity of a sanitary control of the milk supply is strongly urged.

Tubercle bacilli of different origin, M. RABINOWITSCH (*Ztschr. Tuberkulose, 9 (1906), Nos. 5, pp. 457–501; 6, pp. 546–584*).—As a result of numerous cultures and inoculation experiments, the author comes to the conclusion that the biological characters of the tubercle bacillus of cold-blooded animals depend entirely upon adaptation to specific conditions. The organism may be made to produce the typical growth of the mammalian tubercle bacillus by passage through the

body of the mammal or exceptionally this occurs spontaneously. Similarly the mammalian tubercle bacillus may be made to develop the growth of the bacillus of cold-blooded animals by inoculation of the latter. These two forms of the tubercle bacilli are capable of producing typical tuberculous lesions in either warm or cold-blooded animals. It is concluded, therefore, that the tubercle bacilli of men, cattle, birds, and cold-blooded animals are merely vegetative modifications of one and the same species.

Milk and tuberculosis, J. W. Brittlebank (*Vet. Rec., 19 (1906), No. 949, pp. 164, 165*).—In an examination of 10,527 cows kept in city stables only one animal was found to be affected with tuberculosis of the udder. During the same investigation of the milk supply of Manchester, England, 764 samples were taken from milk delivered by 565 different farmers from different counties and in these samples the percentage of tuberculous milk varied from 3 to 12.

Infectious abortion in cattle, B. Bang (*Jour. Compar. Path. and Ther., 19 (1906), No. 3, pp. 191–202*).—It is now 10 years since the author elucidated the etiology of this disease. In the meantime much work has been done along the line of prevention. The author believes that where the nature of the disease is understood the farmer may readily protect his herd against it by proper sanitary precautions.

During the past 3 years the author has carried on experiments in attempting to immunize cows, sheep, and goats against the disease. It has been observed that aborting cows acquire a certain degree of immunity. In this work intravenous injections of serum bouillon cultures of the micro-organism of abortion were adopted. In some cases this treatment produced abscesses and other symptoms of reaction, but considerable immunity resulted, and the author hopes that this method of vaccination will ultimately give a means of controlling the disease.

Immunization toward anthrax, F. Murillo (*Ztschr. Hyg. u. Infectionskrank., 54 (1906), No. 2, pp. 178–188*).—It has often been observed that there may be more or less antagonism between different bacteria or higher plants which are growing in the same medium. The author tested the effect of diphtheria toxin in the attenuation of anthrax cultures. Cultures thus obtained were tested on experimental animals with results which indicate that this method is quite successful in producing immunity.

The author claims certain advantages for this method over the Pasteur system. According to the latter method a temperature of 42° C. is recommended for the attenuation of the anthrax vaccine. By the author's method any temperature up to 37° is satisfactory. It was also found that it is not necessary to use the cultures on a certain day, but that they remain suitable for a number of days after treatment. By combining cultures and toxins in different proportions in ordinary bouillon it is possible to obtain a wide series of gradations in the vaccine.

Anthrax in frogs, F. Ditthorn (*Arch. Hyg., 57 (1906), No. 4, pp. 313–322*).—In inoculation experiments with frogs, the author shows that anthrax bacilli in passing through the body of these cold-blooded animals are not attenuated but remain in condition to affect higher animals and produce an acute form of the disease. In making experiments of this sort it is necessary to observe closely the temperature condition surrounding experimental frogs since frogs are very susceptible to sudden temperature changes.

Prevention of blackleg by the use of the Pasteur blacklegine, H. Bibbey (*Vet. Rec., 19 (1906), No. 950, pp. 168, 169*).—In the use of this vaccine the author makes the inoculation at the root of the tail, which is afterwards washed

with carbolic soap. On the fourth day after inoculation the animals are inspected to see if any abscesses are formed at the point of inoculation. Little or no trouble is ordinarily experienced from the use of this method.

Rinderpest in Egypt, S. ARLOING (*Ann. Soc. Agr. Sci. et Indus. Lyon, 1905, pp. 347–369*).—The conditions observed in outbreaks of rinderpest in Egypt are outlined in considerable detail with notes on the losses caused by the disease, the symptoms observed, and measures taken for controlling the outbreaks. A number of inoculation methods have been tested, usually in combination with the ordinary methods of police sanitation, such as the destruction of infected animals, isolation of exposed animals, and disinfection of premises.

While serum inoculation has admittedly given good results in preventing the spread of rinderpest, the author believes that the successful control of the disease in all cases where serum has been used is to be partly ascribed to the simultaneous application of strict police sanitation. In the future control of rinderpest, the author recommends the destruction of diseased animals and strict quarantine as of prime importance.

Piroplasmoses in Dutch East Indies, C. A. PENNING (*Veeartsenijk. Bl. Nederland. Indië, 18 (1906), No. 1–2, pp. 102–108, pl. 1*).—Both Texas fever and Rhodesian or coast fever occur among cattle in Java. According to statistics collected by the author, cattle become infected with one or both of these diseases at a young age, and about 10 to 15 per cent die before they are a year old. Those which recover possess a lasting immunity to Texas fever and coast fever. It has been observed that cattle which are imported to Java from South Australia become affected with one or the other of these diseases, and the majority of them die within a year after their importation. Notes are given on the symptoms of Texas fever and African coast fever and on the blood parasites observed in cases of these diseases.

Piroplasmosis in cattle (*Svensk Vet. Tidskr., 11 (1906), No. 9, pp. 411–413, pls. 2*).—An outbreak of piroplasmosis closely resembling Texas fever in its general symptoms and lesions occurred among cattle in Sweden, and the disease was investigated by the author. The blood corpuscles seemed to be destroyed, as in the case of Texas fever, so that one of the symptoms in most cases was bloody urine. The cattle were infested with 2 species of ticks, which were identified as *Ixodes ricinus* and *I. hexagonus*.

Scab ordinance, 1903, and the amending scab ordinances, 1905–6 (*Bloemfontein, Orange River Colony: Dept. Agr., 1906, pp. 19*).—Copies are given of the ordinances now in force in the Orange River Colony for the eradication of sheep scab within the colony.

Protective vaccination against braxy, JENSEN (*Berlin. Tierärztl. Wchnschr., 1906, No. 41, pp. 743, 744*).—Three methods have been used in producing immunity to braxy. In the first, a virulent pure culture is mixed with equal parts of bouillon and horse serum and kept at a body temperature for a week before using. The second method consists in the use of a serum obtained from horses after inoculating them with virulent cultures. The author has most confidence in the success of a third method, which consists in placing threads in a culture which is treated with hydrogen until spore formation takes place, after which the threads are introduced into a fold in the skin of the animal to be immunized.

Swine plague and hog cholera, E. JOEST (*Schweineseuche und Schweinepest. Jena: Gustav Fischer, 1906, pp. VIII + 280, pls. 6, figs. 22*).—The present account is of a monographic nature and attempts to present a thorough discussion of the results thus far arrived at by a study of swine plague and hog cholera, and also a statement of the more important problems still remaining to be solved in connection with these diseases. The literature of the subject

is critically discussed in connection with a bibliography including publications down to the end of 1905. A special feature of the work is a discussion of the veterinary police measures adopted in controlling these diseases in various countries of Europe and in the United States. Mention is also made of the contention of W. Grips that *Bacillus suisepticus* is not the cause of swine plague.

The discussions of both swine plague and hog cholera are arranged along the same line and include the etiology, pathology, and methods of infection and control of the disease. Furthermore, an account is given of the problems of mixed infection and differential diagnosis between swine plague and hog cholera and methods of immunization to these diseases.

Hog cholera, E. Leclainche (*Rev. Gén. Méd. Vét., 8 (1906), No. 92, pp. 417–423*).—The author calls attention to the fact that in the early history of the study of this disease it was supposed to include two forms caused by two specifically distinct bacteria. At present swine plague and hog cholera are considered distinct by all investigators, and recently the demonstration of another form of hog cholera not due to any known micro-organism has complicated the problem so that further investigation is necessary.

Bacillus pyocyaneus as a cause of rhinitis and hemorrhagic meningitis in hogs, F. Koske (*Arb. K. Gsndhtsamt., 23 (1906), No. 2, pp. 542–553*).—Young pigs are frequently affected with a disease resembling snuffles in sheep. According to the author's investigations *Bacillus pyocyaneus* may be found in such cases, and in inoculation experiments it was determined that this organism is pathogenic for young pigs and may produce the disease.

The horse; its treatment in health and disease, J. W. Axe (*London: Gresham Pub. Co., 1906, vols. 1, pp. XVIII+1–164, pls. 20, figs. 73, charts 9; 2, pp. X+165–344, pls. 16, figs. 69, charts 4; 3, pp. X+345–512, pls. 13, figs. 65; 4, pp. XII+1–160, pls. 9, figs. 64*).—In preparing this work on the horse the editor has secured the assistance of a number of experts to prepare different technical parts. The work as a whole is intended to contain such information as may be needed by horsemen with regard to the breeding, care, and treatment of the horse.

The anatomy of the horse is described with particular reference to its bearing on health and disease. The same may be said with regard to the physiological discussion. The larger part of the work is occupied with a detailed account of the diseases commonly known to affect the horse. The illustrations serve to show the best types of horses, various points in the conformation of the horse, positions assumed in different diseases, and numerous pathological details. A dissectible plate accompanies the work showing the details of the internal and external anatomy.

Veterinary and biological studies on horse production in Württemberg, H. Sohnle (*Hippologische, veterinärmedizinische und biologische Beiträge zur württembergischen Pferdezucht. Plieningen: F. Find, 1906, pp. 105*).—The author maintains on the basis of his observations that races of the horse or other animals once established in a given locality can not be reproduced in exactly the same form in other localities. Where a given race of the horse appears to be desirable for importation into some other locality it is necessary to import at relatively frequent intervals pure-bred sires from the native locality in order to keep up the form of the race.

Notes are given on a number of common diseases among horses, including azoturia, ophthalmia, arthritis, etc.

Special report on glanders, J. G. Rutherford (*Canad. Dept. Agr., Health of Animals Branch, 1906, pp. 24*).—The essential features of this report were

presented before the New Haven meeting of the Veterinary Medical Association and have been previously noted (E. S. R., 18, p. 99).

Experimental glanders in guinea pigs, M. NICOLLE (*Ann. Inst. Pasteur, 20 (1906), Nos. 8, pp. 625–664; 9, pp. 698–730; 10, pp. 801–837*).—The symptoms and course of glanders in guinea pigs are described in detail and are compared with those of pseudo-tuberculosis and also with the symptoms which appear in rabbits and other animals when infected with glanders. The supersensitiveness to the glanders bacillus sometimes observed in guinea pigs appears to depend upon the condition of the animal, the previous treatment which it has received, and the virulence of the glanders bacillus used in the experiments.

The author has shown that it is possible to immunize guinea pigs to glanders. There are three methods by which this may be accomplished—by repeated injections of small doses of dead glanders bacilli, of living bacilli in minute quantities, or by a single dose of living bacilli in such quantities as barely to produce an infection.

Recurrent mange, F. SMITH (*Vet. Rec., 19 (1906), No. 953, pp. 215, 216*).—The author refers to the difficulties usually experienced in bringing about a complete cure of mange in horses. Most of so-called cases of recurrent mange are due to the fact that the supposed cure in the first instance was only apparent.

Infectious scratches and verminous aneurism, H. WUCHERER (*Wchnschr. Tierheilk. u. Viehzucht, 50 (1906), No. 35, pp. 681–685*).—In a number of young horses the author observed the prevalence of an infectious form of scratches. At first the appetite failed, the flanks became tucked up, and a slight elevation of temperature was observed. After 3 or 4 days phlegmonous swellings appeared about the crown of the hoof and fetlock, followed by an exudation from these points. As a rule, the animals showed marked improvement after about 1 week, but in some cases the disease was much more refractory even after thorough application of disinfectant powders.

Notes are also given on cases of verminous aneurism due to emboly and thrombosis of the anterior mesenteric artery.

The clinical symptoms of malaria in horses, L. BARUCHELLO (*Clin. Vet. [Milan], 29 (1906), No. 31, pp. 745–754*).—According to the author's observations the fundamental symptoms of malaria in horses are fever, icterus, petechiæ, and hemoglobinuria. All of these symptoms are described in considerable detail and notes are given on means of diagnosing between malaria and other diseases with which it might be confused.

The pathology and treatment of pernicious anemia of the horse, J. N. RIES (*Rec. Méd. Vét., 83 (1906), No. 19, pp. 677–683*).—The symptoms of this trouble are described in considerable detail. In many cases the author believes that the chief cause of the disease is excessive infestation with botflies and other parasites.

A case of spirillosis in the horse, R. J. STORDY (*Jour. Compar. Path. and Ther., 19 (1906), No. 3, pp. 226–228, figs. 2*).—This disease in South Africa may be mistaken for dik-kop until after some experience is had. The animal becomes much emaciated and edematous swellings appear on various parts of the body. The most characteristic feature of the disease is the rapid emaciation.

Surra in Africa, L. CAZALBOU (*Rev. Gén. Méd. Vét., 8 (1906), No. 92, pp. 401–417, figs. 5*).—The geographical distribution of surra in Africa is discussed with mention of the symptoms of the disease in camels and horses. Experimental tests proved the possibility of transmitting the disease by contact or by inoculation. A number of insects are commonly believed to be instrumental in transmitting the blood parasite, but it is not definitely known whether they are the only agents of transmission or not.

Trypanosomata and trypanosomiasis, E. N. TOBEY (*Jour. Med. Research, 15 (1906), No. 1, pp. 117–145*).—The present article is a summary of the results of investigation on trypanosomes and the diseases caused by them. The author gives an account of methods of cultivating trypanosomes and of the prevalence of various diseases caused by these organisms, such as surra, dourine, mal de caderas, etc.

Hemorrhagic septicemia in elephants, G. H. EVANS (*Jour. Trop. Vet. Sci., 1 (1906), No. 3, pp. 263–268*).—Hemorrhagic septicemia appears to be of as frequent occurrence in elephants as is anthrax, and shows about the same symptoms as the latter disease. Infection appears to take place largely through skin wounds. Medicinal treatment is of little avail and nearly all cases end fatally. The author had no opportunity to test the serum treatment. The observations recorded in the paper are of importance as indicating another source of infection from this disease.

Lesions in the digestive tract of the horse due to the larvæ of botflies, WEINBERG (*Compt. Rend. Soc. Biol. [Paris], 61 (1906), No. 27, pp. 172, 173*).—From a study of the lesions caused by botflies the author concludes that they cause inflammatory or other injuries to the stomach walls of infested horses without producing any bacterial infection. If, however, pathologic bacteria are present such infection may take place. The botflies are, therefore, to be considered in the same class with parasitic worms in so far as this matter is concerned.

The geographic distribution of Distomum hepaticum, A. SAITO (*Centbl. Bakt. [etc.], 1. Abt., Orig., 41 (1906), No. 8, p. 822*).—According to various authors who have studied the common liver fluke, this parasite occurs in Europe, Egypt, India, Australia, and America. It has heretofore been doubtful whether the parasite is found in China, Korea, or Japan. The author made an investigation of this matter and found fluke worms in 16⅔ per cent of the livers of cattle inspected at the abattoir in Okayama, Japan.

Cysticercus cellulosæ and its detection in living hogs, J. VON KUKULJEVIĆ (*Berlin. Tierärztl. Wchnschr., 1906, No. 34, pp. 626–630, figs. 9*).—A detailed description is given of a practical method of throwing hogs and examining the tongue for the presence of measle worms. This method of examination is easily carried out, but it is recommended that the hogs be not fed on the morning of the examination since they endure the inspection better when the stomach is comparatively empty.

The literature relating to this subject is critically reviewed.

The occurrence of trichinæ among rats, L. BAHR (*Maanedskr. Dyrlæger, 18 (1906), No. 4, pp. 136–139*).—Rats have been examined in many countries for the purpose of determining the percentage of infestation with trichinæ. The literature on this subject is briefly referred to by the author, who carried on an investigation of this sort, during which 371 rats were examined. Of this number 19, or 5.12 per cent, were found to be infested with trichinæ.

The question of poisoning by artificial fertilizers, J. SCHNEIDER and G. STROH (*Deut. Tierärztl. Wchnschr., 14 (1906), Nos. 38, pp. 457–459; 39, pp. 469–471*).—A series of feeding tests was undertaken chiefly with rabbits, sheep, and cattle, during which the experimental animals were fed superphosphate, Thomas slag, and kainit. The feeding periods ranged from 10 to 30 days and the amounts of the different fertilizers were graduated according to the size of the animal.

The conclusion reached from these feeding experiments is that, under ordinary conditions, neither domestic nor wild animals are likely to eat a sufficient quantity of the artificial fertilizers in question to produce poisonous effects.

Examination of the Western Australian poison plants, E. A. MANN (*Jour. Dept. Agr. West. Aust., 13 (1906), No. 6, pp. 486–490, pls. 2*).—A detailed chemical examination was made of *Oxylobium parviflorum*, for the purpose of determining the presence of any poisonous principles in this plant. The method used in making the analyses of the plant is described. An alkaloid was isolated in a pure state and has been called lobine. It is very unstable as compared with most alkaloids, but in many respects resembles cygnin.

In experiments to determine the physiological action of lobine it was found that 0.1 grain dissolved in water was sufficient to cause the death of a guinea pig within 5 minutes after hypodermic inoculation. Further experiments will be made in order to determine more accurately the symptoms and exact fatal dose of the alkaloid. From a few experiments carried out in the laboratory it appears that lobine is readily destroyed by permanganate of potash, and this drug appears therefore to be a suitable antidote.

The harmful character of grape foliage sprayed with Bordeaux mixture, ADE (*Wchnschr. Tierheilk. u. Viehzucht, 50 (1906), No. 37, pp. 721–726*).—On account of the occurrence of cases in which cattle were poisoned or killed by eating grape leaves, an examination was made into the possible causes of such poisoning. It may be due to specific substances in grape leaves, to poisonous compounds produced by the presence of fungus diseases, to poisonous substances developing in parasitic fungi killed on the grape leaves as the result of spraying with Bordeaux mixture, or to the copper contained in the latter. There appears to be little ground for the supposition that the small amount of copper on grape leaves sprayed with Bordeaux mixture is sufficient to cause cases of poisoning which have been observed.

Gastritis in cattle as a result of eating grape leaves, OHLER (*Wchnschr. Tierheilk. u. Viehzucht, 50 (1906), No. 33, pp. 641–643*).—In July and August of every year, when grape vines are pruned, it is customary to feed the leaves to cattle, and a considerable number of cases of gastritis have resulted. In some cases, cows with young calves at their side may transmit the poisonous properties of infected grape leaves in the milk to such an extent as to kill the calves. In the author's opinion, the trouble is at least partly due to the prevalence of the parasitic fungus *Peronospora viticola* on the leaves. Affected leaves decay rapidly and give out a striking and disagreeable odor.

Poisoning by horse-radish, D. FAIRBANK (*Vet. Rec., 19 (1906), No. 946, pp. 117, 118*).—Symptoms of poisoning appeared among Hereford cattle and closely resembled those of colic. Two of the animals died and a post-mortem examination, as well as a study of the condition under which the trouble arose, showed that these were cases of poisoning from eating too much horse-radish root.

Cirrhosis of the liver in stock in Cape Colony, produced by two species of Senecio (Sebecio burchelli and S. latifolius), W. ROBERTSON (*Jour. Compar. Path. and Ther., 19 (1906), No. 2, pp. 97–110, figs. 5*).—It has been known for some time that *Senecio burchelli* causes a cirrhosis of the liver in live stock in South Africa. During an investigation of various cases of this disease the author found that *S. latifolius* might also cause the same disease with fatal results. Detailed notes are given of the symptoms and the post-mortem findings in these cases.

RURAL ENGINEERING.

Topography, C. MURET (*Topographie. Paris: J. B. Baillière & Sons, 1906, pp. 499, pls. 9, figs. 186*).—A treatise on the practice of surveying, with special reference to its application in modern agriculture. It includes six chapters

treating the following subdivisions of the subject: definitions, maps, and scales; description of instruments used for various purposes; testing and adjustment of instruments, allowable errors, etc.; methods of leveling; general use of instruments and methods of surveying; special applications; land subdivisions and establishment and verification of land titles.

The assessment of drainage districts, L. E. ASHBAUGH (*Chicago: Western Society of Engineers, 1906, pp. 14, figs. 2*).—A discussion of the methods of making assessments of land in drainage districts as governed by the principle that assessments must be proportionate to benefits received. Arithmetical examples are given showing how to distribute expenses over the various tracts of a drainage enterprise.

Cement drain pipe (*Masch. Ztg., 4 (1906), No. 16, p. 189, fig. 1*).—Cement drains are said to have certain advantages over the usual tile in that the latter are seldom round and become warped and bent in burning, while the former are clean and glazed on the interior and are of uniform size and shape. The desired porosity can be given the cement pipe by using a mixture by volume of one to eight. It is claimed that cement pipes are cheaper than the earthenware tile and that they show no deterioration in use.

A hand-operated machine is described by which cement pipe can be very conveniently made in lengths of 13 in., and of diameter from 1 to 9 in.

Artesian irrigation, W. R. FRY (*Agr. Gaz. N. S. Wales, 17 (1906), Nos. 6, pp. 581–588, figs. 6; 7, pp. 683–695, figs. 5; 8, pp. 780–789, figs. 4*).—The author discusses the possibility of irrigating portions of New South Wales by artesian water. While irrigation is not always necessary, the country frequently suffers from droughts, and in the absence of permanent streams, irrigation from artesian wells or by pumping from driven wells becomes a necessity.

The underground water, however, is saline in character, usually containing 44½ grains of solid matter per gallon, most of which is sodium carbonate. After 7 years of irrigation with this water, an analysis of the soil as compared with virgin soil from the same locality shows no increase in the alkaline content, which probably "is due to the method of cultivation adopted." This consists in careful furrow irrigation, the aim being to get the water into the soil rather than on it. The soil in the locality where most experiments have been carried on contains 18 per cent of sand and 71 per cent of fine matter, chiefly clay. The crops successfully grown are the cereals, saltbush, sorghum, cowpeas, and melons. Orchards are also successfully irrigated.

Irrigation in the Transvaal, F. A. HURLEY (*Transvaal Agr. Jour., 4 (1906), No. 16, pp. 733–742*).—The writer discusses some of the practical aspects of the irrigation situation in the Transvaal and indicates some of the difficulties attendant upon the introduction of irrigation in that region. One of the chief of these is the present water law, which is based upon the primitive water laws of other countries, and under which it is impossible to secure a permanent water right. The water laws are at present under investigation by a commission. Other difficulties encountered are the physical features of the country, ignorance of hydrographic conditions, popular ignorance of the manner in which it is desirable to prepare estimates for irrigation schemes, labor, and transportation, the state of the markets, and lack of cooperation among farmers.

With regard to the government policy to be pursued, the author suggests a campaign of education in order to outline the manner in which the different districts are to be finally irrigated; then, if the law permits, the construction or encouragement of small schemes, or the construction of large schemes where future development may render them desirable.

The duty of water, A. McPherson (*Forestry and Irrig., 12 (1906), No. 9, pp. 417-421, pl. 1*).—This article gives results of experiments made on the experimental farm of the Twin Falls (Idaho) Land and Water Company during 1906. It was found that the total amount applied on the farm was 36.10 in., which, deducting wastage and an assumed soil evaporation of 28.06 in. (based on evaporation from water surface), leaves 5.7 in. as the amount retained by the soil.

The flooding and furrow methods of irrigation are discussed and the conclusion reached that the furrow method is the more satisfactory.

Memorandum dated August, 1875, on the irrigation duty of water and the principles on which its increase depends, J. S. Beresford (*Punjab Irrig. Branch Papers, No. 10, pp. 1-11*).—Notes on the so-called efficiency of canals and a treatment of the nature and theory of absorption and percolation from which it is concluded that the total absorption loss varies as some function of the length of distributary. The theory is advanced, based on observed facts, that more waste of water by absorption occurs in excavated than in embanked channels. The seepage losses from the Ganges canal are said to be "capable of raising the springs over an area of 4,500 square miles to a height of 1.12 ft. in 12 months."

Note on irrigation duty of the Ban Doab Canal, dated April, 1883, R. G. Kennedy (*Punjab Irrig. Branch Papers, No. 10, pp. 12-25*).—Data are given on the rate of absorption of water as determined by experiment on a flooded field of loamy soil, from which it was found that the absorption could be expressed by the equation $y=0.0891\ x^{0.86}$ where y=depth of water over the surface absorbed and x=the number of days under water. The rate of absorption or loss by seepage in case of a canal was found to vary from 0.035 ft. in depth per hour over a gravelly open bottom to 0.0079 on the lower silted-up reaches of the canal, the surface upon which such measurements were based being the total area of water surface between given points.

Experiments on gauging the supply entering Rajbahas by means of the headgates (*Punjab Irrig. Branch Papers, No. 8, pp. 20, pls. 2, figs. 4*).—A series of papers giving the results of observations, the object of which was to determine the coefficient to be used in the usual submerged weir formula when applied in the measurement of water by ordinary lateral headgates. It was found that the coefficient varied somewhat with the pressure head and with the width of the gate. For a width of gate of 10 ft. the normal value of coefficient was found to be C=0.79. When the width was other than 10 ft. and not over 12 ft. the coefficient (0.79) is to be multiplied by a quantity $X=b\dfrac{(0.7201+.0074b)}{7.943}$ in which b is the width in feet. This modified coefficient may then be applied in the formula for a submerged weir $Q=C.\ b.\ h.\ 8.02\sqrt{H}$, in which h=height of gate opening in feet; H=working head in feet or the difference between the depth in the canal and in the lateral measured above the sill of the gate, and Q=discharge in cubic feet per second.

Notched falls, A. G. Reid (*Punjab Irrig. Branch Papers, No. 2, pp. 18, figs. 3*).—A description of measuring devices "consisting of a vertical wall extending across the channel and of a height above the upstream bed equal to the full supply depth in the upstream reach. In this wall one or more trapezoidal notches are cut from the crest downward through the whole height of the wall to the level of the upstream bed." The notches are of such size as will pass the entire maximum flow without causing the stream to back up. For the determination of flow through such a notch various formulæ are derived, taking into

account whether the notch has a free outfall, velocity of approach, etc., and examples are given illustrating their application.

Triennial revenue report of the public works department, irrigation branch, Bengal, for the three years ending 1904–1905 (*Trien. Rev. Rpt. Pub. Works Dept., Irrig. Branch, Bengal, 1904–5, pp. 94, dgms. 7*).—Statistics relating to the cost, operating expenses, and revenues of the canals of Bengal. Figures are also given of areas irrigated, crops grown, and duty of water on rice and other crops, together with items of interest on administration and control.

Silting operations (*Punjab Irrig. Branch Papers, No. 5, pp. 43, pls. 10, fig. 1*).—A description of methods of strengthening the banks of a canal when the bed is out of the soil or but little within it, chiefly by means of large subsidiary basins parallel to the canal through which all or a portion of the water of the canal is caused to flow, resulting in the deposition of silt in such basins up to the usual water level of the canal.

How horizontal runs affect the air lift, H. T. ABRAMS (*Municipal Engin., 31 (1906), No. 4, pp. 297, 298*).—A discussion of the results of experiments made by the writer upon a well operated by the air lift, where after leaving the well the water had to be conducted some distance by a horizontal pipe and then elevated into a reservoir. It was found that the horizontal run greatly impaired the action of the air lift and that it is much more economical under such conditions to raise the water by the air lift to a tank at the surface, after which the water may be forced by an air pressure or displacement pump through the horizontal run to the elevated tank.

Air-lift pumping, G. C. H. FRIEDRICH (*Compressed Air, 11 (1906), No. 6, pp. 4140, 4141*).—A discussion of this method of pumping and giving tables on submergence and efficiency; capacity and pipe sizes; and on the relation between lift, submergence, and air needed for air-lift pumping.

Tests of a new centrifugal pump (*Engin. Rec., 54 (1906), No. 13, pp. 352, 353, figs. 5*).—A report of tests made upon a 2-stage shrouded runner centrifugal pump of such design that it may readily be taken apart for inspection of the interior without disconnection of the suction or discharge pipes, or may be made into a simple pump or one of any number of stages by mere removal or addition of parts. In the form tested an efficiency of 77.79 per cent was shown at 600 revolutions per minute when delivering 3,255 gal. per minute at 100.7-ft. head.

On the uses of the centrifugal pump (*Masch. Ztg., 4 (1906), No. 16, p. 189*).—In an article by Gramberg in *Braunkohle*, the author mentions a technical but rather important consideration in the operation of the centrifugal pump when same is run by electric motor. "The pressure head against which the pump works is often less than that for which it is designed, and in this case it is found that the motor overheats on long runs, due to excessive current consumption following from the reduction of head. It is a singular fact that a reduction of pressure head should result in an increased power consumption, but such is the case. This is due to the fact that reduction of pressure head causes increase in discharge, the net result being increase in current required. To obviate this loss pumps which are designed for a higher head can be increased in efficiency by placing a valve in the discharge pipe near the pump. By this means it is possible to produce a throttling effect, increasing the pressure and thereby reducing the discharge, and in turn cutting down the current consumption."

Wind power, E. L. BURNE (*Cassier's Mag., 30 (1906), No. 4, pp. 325–336, figs. 10*).—The writer discusses the various types of wind wheels and

gives data upon their performance under different conditions. Since wind pressure increases as the square of the velocity it follows that the product of speed and pressure increases as the cube of the velocity. The power of the windmill should therefore vary in the same proportion, hence in order to use as much as possible of the force of the wind the mill should operate machinery in which the load increases somewhat in the same proportion as the wind pressure increases with the velocity. For this reason a centrifugal pump works well in combination with a windmill, likewise a constant potential generator for charging storage batteries. Results of experiments by the Danish government are quoted, giving rules for dimensioning and weathering the sails.

Experiments in England conducted by the Royal Agricultural Society are also cited. The dimensions of the mill securing first prize are given in detail. From an analysis of the performance of the various mills it is found that "nothing is gained by providing sail area for more than about 66 per cent of the total surface of the wheel."

"The most suitable angle of weather for the tips of the vanes appears to be about 35 degrees when their velocity is the same as that of the wind. The best number of vanes appears to be a mooted question."

The windmill as a farm power (*Farm Implements, 20 (1906), No. 9, pp. 42–44*).—A popular article transcribed from the *Canadian Thresherman and Farmer*, giving a historical sketch of the development of the windmill and citing some of the experiments which have been conducted from time to time with a view to increasing its efficiency and suitability as a farm and general utility motor.

Dynamo run by windmill (*Engin. and Min. Jour., 82 (1906), No. 21, p. 976*).—An electric lighting plant operated by wind power is reported to have been installed at Noblesville, Ind., consisting in part of a 14-ft. windmill on a 50-ft. tower. The windmill operates a plunger pump delivering water to a reservoir where pressure is maintained constant by automatic devices. The water under pressure is used when necessary to drive a 5-horsepower turbine wheel, direct-connected to a ¼-horsepower, 25-volt dynamo which charges a storage battery. The battery is of sufficient capacity to light twenty 8-candlepower lamps for 3 hours. In order to generate sufficient current for winter use the windmill must operate 5 hours per day, and for summer use, 2 hours per day.

Test of a small gasoline electric light plant (*Gas Engine, 8 (1906), No. 11, pp. 348, 349*).—This is a report upon a test of a plant of a type used for the lighting of farm residences, barns, and other buildings by the electric incandescent lamp. The engine is belt-connected to the generator and may be used for other power purposes. The test was conducted at the Kansas Agricultural College and showed that for a full load of eighteen 16-candlepower, 110-volt incandescent lamps, the fuel consumption was 1.35 qts. of gasoline per hour. This makes the cost per horsepower hour, $0.0253, with gasoline selling at 15 cts. per gallon. The fluctuation of voltage was found to be less than 1 per cent when operating at a normal pressure of 110 volts, and the variation in light as compared with lamps supplied with current from the usual steam plant was found to be hardly appreciable.

Explosion motors and the injection of volatile liquids, K. SCHREBER (*Rev. Gén. Sci., 17 (1906), No. 16, pp. 734–745, figs. 5*).—A mathematical discussion of the desirability of injecting cooling water into the working cylinder of the gas engine. It is concluded that the method of injecting water at the moment of explosion is neither effective nor economical. The author advances particularly

a thermodynamic theory of a 2-cycle alcohol motor with water injection during the compression stroke. This theory is based upon facts drawn from experiments with such a motor of his own invention.

Efficiency tests of a producer gas engine direct-connected to centrifugal pump (*Engin. Rec., 54 (1906), No. 20, p. 560, fig. 1*).—The results are given of tests upon a producer gas pumping plant, which is one of a number of low-lift pumping stations required to handle large quantities of water under the flood conditions sometimes prevailing in the drainage system of New Orleans. The gas producer has a rated capacity of 100 hp. and supplies gas to a 12.5 by 13 in. 3-cylinder, 2-cycle gas engine connected to a 24-in. centrifugal pump rated at 27 to 30 cu. ft. per second against a total measured lift of 14 ft.

Pittsburg nut anthracite coal, of a heating value of 14,500 British thermal units per 1 lb., was employed, this producing a gas of 115 British thermal units per cubic foot at 60° F. and 760 mm. pressure. The average of the principal results obtained during the 6-day test are as follows:

Revolutions per minute of engine, 296.6; brake horsepower, 70.6; engine efficiency, 78 per cent; pump efficiency, 71 per cent; discharge, 30½ cu. ft. per second; mean velocity of water in pipe, 6.21 ft. per second; total head, 13.36 ft.; coal per hour per brake horsepower, 1.093 lbs.; average duty, 119.6 million foot-pounds per 100 lbs. of coal.

Wood-gas for power purposes (*Masch. Ztg., 4 (1906), No. 16, pp. 189, 190*).—A producer plant using a species of oak as a fuel is in use at Nacozari, Mexico. The operation consists first in getting a thick bed of glowing coals of light wood and coke, on which the heavier wood is then thrown to a depth of 2 ft., after which the producer is connected to the engine. The preliminary operation requires from 4 to 5 hours. When consuming daily about 15 tons of wood, the generator must be cleaned every 5 days. The average heating value of the gas was found to be 1,028 calories, and the consumption of wood and coke 2.57 lbs. and 0.11 lb., respectively, per electrical horsepower hour. It is stated that considerable advantage is found in this type of plant from the standpoint of economy in fuel consumption, but that in other respects it does not compare favorably with a steam plant.

Denatured alcohol. Investigations in Europe of its cost and use.—What may be expected in the United States (*Daily Consular and Trade Rpts. [U. S.], 1906, No. 2666, pp. 1-3*).—A denaturing establishment in London is described, consisting merely of tanks arranged on the second, third, and fourth floors of a building and communicating by means of a system of pipes with tanks on the first floor. The tanks on the second, third, and fourth floors contain ethyl alcohol, wood alcohol, and methylated materials, respectively, and the mixing is done in the tanks on the first floor.

It is stated that the idea that alcohol corrodes the cylinders and valves of engines is scoffed at in Germany. With reference to the use of alcohol for illuminating purposes, the following is stated: "Industrial alcohol is now used in Germany in small, portable lamps, which give it all the effects of a mantel burner heated by gas. The expense for alcohol is only about two-thirds as much per candlepower as is the cost of kerosene. Even at 25 or 30 cts. a gallon, denatured alcohol can successfully compete with kerosene as a means of lighting."

Potato evaporating plant and auxiliary operations on Hammer domain, Kr. Wohlau, REHFELD (*Masch. Ztg., 4 (1906), No. 18, pp. 205, 206*).—A description of a plant devised to use a portable steam engine of 10 to 12 horsepower, with a boiler of 16-square-meters heating surface. The exhaust steam of the engine is used for the evaporation of the potatoes, and the power deliv-

ered by the engine is used not only for the operation of the evaporator, but also for pumps, oat rollers, shredders and choppers, a circular saw, and milk separators.

The capacity of the plant is 5 tons of raw potatoes of 19 per cent starch content per 24 hours. With less starch content the capacity is correspondingly reduced. The total running expenses per 24 hours are $6.70. The claim is made that this sort of plant is very profitable, as the dried potatoes can be shipped to distilleries and other potato-using plants at great saving in transportation charges, or in case the market is not favorable, the potatoes can be used as a cattle food, a use for which they are well adapted.

Tarred road. Successful results in France—Application methods (*Daily Consular and Trade Rpts. [U. S.], 1906, No. 2700, pp. 1–3*).—In refutation of a statement to the effect that tarred roads are unsuccessful in France it is affirmed on reliable testimony that tarred roads have been uniformly successful wherever the conditions have been normal and the work properly performed. The method of tar treatment in France is similar to that elsewhere. In the first coating about 1 gal. of liquid tar for 3 sq. yds. is given; in the second coating, 1 gal. for 4 sq. yds.

The tar must be laid on a thoroughly dried and swept surface, otherwise it does not harden readily and is picked up by the wheels of passing vehicles, a circumstance to which is probably due the adverse criticism. Cleaning by machinery does not do the same injury to tar-treated roads as to the ordinary macadam and the protection from wear and tear from this source, as well as the better wearing qualities under the ordinary wear and tear of traffic conditions, is said to produce an economy which balances the extra cost.

New road-tarring machine (*Surveyor, 30 (1906), No. 767, p. 380, fig. 1*).—A machine is described by which the operations of cooking, sprinkling, and spreading by brooms are effected simultaneously. The tar is applied at a temperature of 200° F., and it is claimed that a surface of 2,000 sq. yds. may be uniformly covered per hour. The cost of the first two coats is put at about 1½d. per square yard, with tar at 1½d. per gallon.

A new fertilizer-spreading machine (*Masch. Ztg., 4 (1906), No. 17, pp. 200, 201, figs. 3*).—In the operation of the usual machine in which the fertilizer is forced by a roller through holes in the bottom of the receptacle a serious difficulty is often experienced by clogging, due to excessive moisture in the fertilizer. To obviate such trouble and to properly disintegrate the material an apparatus has been devised in which "the bottom of the receptacle is formed of two peculiar spring brushes whose ends press upon a roller rotating between them. The roller is provided with projections arranged in a spiral, and when in operation these projections strike the brushes, thus disintegrating the fertilizer and allowing it to escape through the triangle-shaped orifices caused by the opening of the springs forming the brush. The volume of fertilizer to be distributed is varied by changing the number of revolutions of the roller, which is connected to the wheels of the machine by interchangeable gearing."

Cements, limes, and plasters. Their materials, manufacture, and properties, E. C. ECKEL (*New York: John Wiley & Sons; London: Chapman & Hall, Ltd., pp. XXXIV+712, pls. 8, figs. 157*).—In this volume the author has summarized all the existing information on limes, plasters, and allied materials, the work covering the composition and character of the raw materials, methods of manufacture, and properties of the various cements.

RURAL ECONOMICS.

The new agricultural movement in Cape Colony, P. J. HANNON (*Proc. Roy. Colon. Inst., 37 (1905–6), pp. 214–221*).—This is a paper read at a meeting of the Royal Colonial Institute of London, in April, 1906.

The author discusses the past and present conditions of agriculture in the colony, and points out the recent progress made in agricultural cooperation in winemaking, creameries, wool industry, animal breeding, growing and marketing fruits, sinking of wells, sheep farming, erection of granaries, construction of irrigation works, introduction of new seeds, and other schemes. The movement is aided by government loans and by registered cooperative associations. Expert advice is also given by government agents in "providing plans and specifications for buildings and plant, as well as making inspections and advising the committees from time to time."

The progress made in agricultural cooperation since 1904 leads the author to hope "that the 'self-help by mutual help' spirit displayed by our farmers, supported by the well-conceived financial assistance of the State, will awaken a wide interest in the future prosperity of this important subcontinent of the British Empire."

Cooperation in agriculture (*Agr. Jour. Cape Good Hope, 29 (1906), Nos. 3, pp. 331–342; 4, pp. 512–517*).—This consists of extracts from the report of P. J. Hannon, superintendent of agricultural cooperation in the colony. The results are noted from another source (see above).

The new agriculture, B. LANDRETH (*Proc. Amer. Phil. Soc., 45 (1906), No. 183, pp. 166–177*).—This paper briefly describes the progress made in the application of steam, electricity, and scientific knowledge to agriculture along the lines of the preparation of the soil, harvesting crops, control of insect pests and fungus diseases, forcing of plants, soil inoculation, and the use of electric air currents in plant development.

The organization of agriculture in the Netherlands, J. FROST (*Agrarverfassung und Landwirthschaft in den Niederlanden. Berlin: German Agr. Soc., 1906, pp. 495, maps 6*).—This is a general treatise on the development and organization of agriculture and related industries in the Lowlands.

Statistical data are reported and discussed in part 1 regarding the climate, classes of land under cultivation, waterways and highways, and transportation facilities.

Parts 1 to 3 deal more directly with the economic aspects of agriculture, and include information regarding the past and present status of farm holdings, labor relations, agricultural organizations and education, systems of culture, crops raised and disposition of crops, animal production, cooperative societies for the purchase and sale of products, the methods of raising capital for investment, and other topics relating to the economics of agriculture.

Annual report on the working of the cooperative credit societies act of 1904 in the Bombay Presidency during the year ending 31st March, 1906, J. MCNEILL (*Bombay: Govt., 1906, pp. 23*).—Included in the report are tabulated statistics giving details of each society as to origin, location, receipts and disbursements, rates of interest, assets and liabilities, profits and loss of operation, and classification of loans. In summarizing the year's work, the author says: "The general progress made is, I think, satisfactory. While the number registered at the close of the year was 31, the total number now registered [July 10, 1906] is 45 in 11 districts and the city of Bombay. The only failure is the rural society at Unkal."

Report on trade in agricultural products, L. VASSILLIERE (*Notice sur le Commerce des Produits Agricoles. Paris: Govt., 1906, pp. VII + 461, maps 3*).—This report contains detailed information regarding the extent and disposition of agricultural plant products in France, a forthcoming volume being devoted to similar data relating to animal production.

The situation, configuration, and climate of each department are described, and the adaptability of each province for raising certain crops is indicated. Statistics are then given relating to the production of forestry products, forage crops, cereals, vegetables, fruits, and flowers in the various divisions of each province, the quantities there utilized as food supplies or in manufactures, and the amounts shipped to other departments and foreign countries, the statistics being frequently compared with similar data for preceding years.

A detailed list is appended of the principal places in each province devoted to the raising of definite crops, particularly fruits and garden truck.

The world's grain production in 1906 (*Die Getreideproduktion der Welt im Jahre 1906. Budapest: Min. Agr., 1906, pp. 116*).—The data tabulated and discussed in this volume include the number of hectares planted to different grain crops, the yields per acre, total yields in various countries, and the classes and quantities of grain imported and exported by the great grain-consuming and grain-producing countries of the world. The statistics given are for the year 1906 in comparison with the two preceding years.

[Agricultural statistics, 1905], E. T. MULLENS (*Rpt. Min. Agr. Natal, 1906, pp. 32, dgm. 1*).—This report by the minister of agriculture for the Colony of Natal gives detailed notes on the opening up of Zululand for farm settlement and the extent of colonial progress in agriculture, and reports statistics relating to special and general farm products imported and exported during the year 1905, the development of the various industries being indicated by reference to similar data for the year 1896.

An appendix contains a report by J. C. Parker as to the results of trout introduction into Natal.

Third report on Hawaii (*Bur. of Labor [U. S.] Bul. 66, pp. 365–688*).—This report by the United States Commissioner of Labor relates in general to all forms of labor in Hawaii. But since the islands, on account of their volcanic origin, are "dependent for economic prosperity upon agriculture alone," the statistics presented and discussed relate mainly to this industry.

The bulletin furnishes detailed data on the capital invested in agricultural pursuits, dominance of the sugar industry in Hawaii, number and character of the rural population, extent of immigration and emigration of oriental labor, land and its settlement, small farming, stock raising, different classes of farm labor and their standards of living, together with other statistics bearing on the agricultural and industrial development of Hawaii.

AGRICULTURAL EDUCATION.

Agricultural education, L. H. BAILEY (*Ann. Rpt. N. J. Bd. Agr., 33 (1905), pp. 131–154*).—In this address is given a brief account of the early discussions and movements for agricultural education in this country, dating from 1794 to about 1860. Michigan is given credit for the oldest existing agricultural college in North America, which was opened to students in 1857, and F. G. Cary is said to be "practically the first professor of agriculture in this country, since he seems to have been the first to successfully organize a college for this kind of work." This was a literary academy started in 1833 at College Hill, near Cincinnati. "It gradually took hold of the affairs of the community and became 'The Farmer's College,'" but "finally passed into a military institute."

The gradual evolution is traced of the idea that the State in some way should foster agricultural education. The question of class education is disposed of by the statement that the primary object of the agricultural colleges is "not to make farmers but to make citizens, and the State is always justified in educating citizens. These citizens who live on farms should be educated in terms of their own lives if they are to be efficient citizens." Other classes of citizens are said to be benefited more than farmers by tariffs and other forms of legislation, hence the maintenance of agricultural education may be considered in part an offset for the special privileges the State gives to other classes of citizens.

The enactment of the Land-Grant Act of 1862, the second Morrill Act, and the Hatch Act are taken as indications that the policy of extending Government aid to agricultural institutions is now well accepted. It is argued that the States themselves should contribute liberally to the support of these institutions.

The progress of the agricultural colleges in developing this new education is traced, and attention is called to the work now being done to develop courses in home economics and to the desirability of improving the architecture of farm buildings and developing courses in rural economics and rural sociology. "The result of all this work has come to be that the general tone of farm life has been greatly elevated."

The need of improved country schools is pointed out, and the work of the agricultural colleges in bringing about improvement in these schools is commented on. As a result of this it is said that "about 40 of the States, Territories and provinces have taken some kind of official action looking toward the introduction of agriculture and nature study into the schools." The writer thinks it a mistake to push technical agriculture into these schools very rapidly. "The general pedagogical efficiency of the school must be elevated, the agricultural work coming gradually and naturally as the school develops." But "some kind of local work is essential for the best efficiency in every school, and in the rural districts this local work is necessarily largely agricultural. If the existing schools can not handle these local subjects satisfactorily, it is an indictment against their efficiency as educational means."

Agriculture as taught in summer schools for teachers, the movement for the consolidation of rural schools, and the organization of special agricultural schools are other topics considered in this connection. Attention is also given to changes needed in methods of teaching so as to make reading, number work, geography, and manual training more suitable for rural communities. The winter course of instruction in agricultural colleges is mentioned as one of the temporary but necessary and highly important features of agricultural college instruction.

The American school system with special reference to institutions for agricultural instruction, H. MATZAT (*Landw. Jahrb., 35 (1906), No. 5, pp. 667-734*).—This is a description of the American system of education, based on information gathered by the writer in a visit to the Louisiana Purchase Exposition and to leading educational institutions in different parts of the United States, as well as on the study of numerous text-books, reports, and published articles. As a basis for a better understanding of the system of agricultural education, a description is given of educational institutions in general, including elementary and secondary schools and colleges, and the system of managing schools, teachers, coeducation, etc., is discussed.

Under the topic, Agricultural Education in America, the writer discusses its history and development, the scientific study of agriculture, higher agricultural instruction, and secondary and primary agricultural instruction, and endeavors to draw conclusions with reference to the application of American methods to German institutions. He gives at considerable length the courses of study and

methods followed by a number of the leading American agricultural colleges, and gives figures to show the number of students taking the four-year agricultural courses in all of the agricultural institutions in this country.

The writer concludes that, judging by the rapid progress America is making in education, it is in a fair way to outstrip Germany not only in agricultural, industrial, and commercial lines, but also intellectually. The principal advantage he finds in the American system of education is free tuition, by means of which talent wherever found is stimulated to free and full development. He quotes figures to show that in America it is eight times as easy for the children of poor parents to go through the secondary schools and colleges as it is in Prussia, and concludes that it is not strange therefore that self-made men are so much more numerous in America than they are in Prussia. He favors the extension of the free-school system in Prussia as rapidly as circumstances will permit, and recommends as a first step in this extension the development of winter courses in the regular schools by means of which country children from 11 to 13 years of age, who are needed at home during the summer, may be able to attend school during the winter months and continue to do this until they are 16 or 17 years old.

He also finds that the greater adaptability of American schools to local conditions is worthy of imitation. He favors the extension of the system of elective courses, and also believes that the Prussian schools devote too much time to language study for the purpose of acquiring facility in the use of words rather than the acquirement of facts. And, finally, he says that Prussian schools have no occasion to rest on their laurels, but should rather watch American progress and not delay too long the adoption of such improvements as are practicable.

MISCELLANEOUS.

Experiment Station Work, XXXVII (*U. S. Dept. Agr., Farmers' Bul. 267, pp. 32, fig. 1*).—This number contains articles on the following subjects: Breeding corn; buckwheat; sugar beets on alkali soils; alfilaria as a forage plant; apple bitter rot; grass mulch for orchards; hardiness of young fruit trees; protecting cows from flies; effect of silage on milk; and cold storage of cheese.

Farmers' bulletin subject index, G. W. HILL (*U. S. Dept. Agr., Div. Pubs. Circ. 4, pp. 13*).—A list of subjects in alphabetical order of the Farmers' Bulletins now available for distribution.

The healthful farmhouse, HELEN DODD (*Boston: Whitcomb & Barrows, 1906, pp. X+69, pls. 5, figs. 8, dgms. 3*).—On the basis of experience the arrangement and care of different rooms in the farmhouse are discussed with a view to securing greater comfort and lessening work, and suggestions are made regarding plumbing, furnishing, and related questions.

The volume contains an introduction and a supplementary chapter on the opportunity of the consolidated school by Ellen H. Richards, particularly along manual training lines.

NOTES.

Colorado College and Station.—The legislature has been asked for considerable funds for new buildings, additional equipment, and extension of investigations.

Georgia College.—A department of forestry has been inaugurated at the University of Georgia, with Alfred Akerman, formerly State Forester of Massachusetts, in charge.

Iowa College.—The various short courses offered by the college this year enrolled nearly 1,000 students. The board of trustees donated a free scholarship to each farmers' institute in the State, and these scholarships were awarded to about 100 students.

Kansas College.—The *Industrialist* states that the total enrollment is now nearly 2,000. Many parallel classes have been organized and more will be required. The new horticultural hall, though not yet completed, is fully occupied. A very successful series of meetings was held at the college from December 27 to January 5. These included a State farmers' institute with classes in grain and stock judging, meetings of the Boys' Corn Contest Association, the State Corn Breeders' Association, Good Roads Association, Draft Horse Breeders' Association, Dairy Association, Aberdeen Angus Association, and swine breeders.

Louisiana Stations.—W. G. Taggart and A. P. Kerr, of the Mississippi College, have been appointed analytical chemists at the Baton Rougs Station. A. B. Joffrion has resigned to accept a position in a large sugar factory in Porto Rico.

Massachusetts College and Station.—A bill has been introduced into the legislature to change the name of the station from the Hatch Experiment Station of the Massachusetts Agricultural College to the Massachusetts Agricultural Experiment Station. A professorship of pomology is to be established in the college. H. F. Tompson, a graduate of the college in 1905, has been appointed instructor in market gardening and supervisor of field work. Prof. G. F. Mills has been made dean of the college and professor of the humanities, a chair newly established, having for its object the closer correlation of the agricultural, technical, scientific, and cultural studies of the curriculum.

Michigan College.—F. H. Sanford, a graduate of the college in 1904, has been appointed instructor in forestry to assist Professor Bogue.

Nebraska University and Station.—We learn from *Agriculture* that the legislature is to be asked for $220,000, of which $180,000 is for the completion of a woman's building, horticultural building, judging pavilion, and poultry plant in the college of agriculture; $25,000 for the maintenance of the substation at North Platte, and $15,000 for farmers' institutes.

Ohio Station.—J. H. Show has resigned as assistant chemist and has been succeeded by S. S. Fay, of the University of Nebraska. The station has begun the erection of a glass house to be used in soil study.

Rhode Island Station.—A. W. Richardson, assistant in agronomy, has resigned and is succeeded by S. C. Damon.

South Dakota Station.—At a recent meeting of the board of regents a resolution was adopted, pointing out the desirability of establishing at least two

new substations for dry land farming, one for the northern and one for the central portion of the tract lying west of the Missouri River. It is proposed that these branch stations shall be under the management and control of the station at Brookings, and an initial appropriation of at least $3,500 for each is mentioned, with $3,000 annually thereafter. The resolution is to be presented to the legislature with request for action, including the setting aside of at least two sections of land for the use of the proposed substation.

Virginia College and Station.—The agricultural club of the college of agriculture has begun the publication of a bi-monthly periodical, called the *V. P. I. Agricultural Journal.* Harry H. Hill has been appointed assistant in the chemical department of the station.

Wyoming University and Station.—G. E. Morton, of the department of animal husbandry, has resigned to accept a similar position in the Colorado College. John A. Hill, a senior student in agriculture in the university, is taking up special work at the Philadelphia Textile School in preparation for researches upon wool at the station. This work will consist chiefly of studies of Wyoming wools and wool scouring, and the effect of different feeds, alkali soils, and cross-breeding on the character and quality of western wools. The station recently obtained 72 breeding ewes from different parts of the West, to be used in breeding experiments under range conditions in cooperation with the Bureau of Animal Industry, in an attempt to establish a typical western range sheep with improved mutton qualities and which will shear a heavy fleece of fine wool.

A new series of dry farming investigations have also been undertaken in cooperation with the Irrigation and Drainage Investigations of this Office. In this connection the station will take up the study of soil moisture and its conservation to determine some of the underlying principles of successful farming without irrigation, where the rainfall is less than 15 in.

Association of American Agricultural Colleges and Experiment Stations.—It is announced by the executive committee that the next meeting will be held at Lansing, Mich., during the week of May 26.

Georgia Agricultural Schools.—Meetings of trustees to decide upon the location of Congressional district industrial and agricultural schools in Georgia have been held in 10 of the 11 districts. In nearly every instance the competition between different localities in the districts has been very sharp, and the contributions, consisting of pledges of funds, land, electric lights, water, sewer systems, telephone service, etc., have been liberal. The smallest cash contribution for buildings was $15,000 and the largest $60,000.

The location of the schools and the estimated value of the contributions in the different districts are as follows: First district, Statesboro, $100,000; second district, Tifton, $110,000; third district, Americus, $75,000; fourth district, Carrollton, $60,000; fifth district, Monroe, $56,000; sixth district, Barnesville, $86,000; seventh district, Powder Springs, $40,000; eighth district, Madison, $75,500; ninth district, school not yet located; tenth district, Granite Hill, $58,000; eleventh district, Douglas, $90,000.

Plans for the different buildings, subject to slight modifications by the respective boards of trustees, have been drawn by an architect employed by Governor Terrell. These plans contemplate a main building, a girls' dormitory, a boys' dormitory, a domestic science and dining hall, power house and shops, 4 cottages for instructors, and barns and other farm buildings. The main building and at least one dormitory will be erected at once in every district, and in some districts the girls' dormitory, the power house and shops, and the domestic science and dining hall will be erected at the same time.

At a recent meeting the board of trustees of the Georgia State College of Agriculture and Mechanic Arts decided that the minimum age for entrance into

the schools be 14 years for boys and 13 years for girls; that the course of study be limited to 4 years, one of which shall include common school or elementary studies, and that the scholastic year be 40 weeks. A minimum of 3 hours of class-room work in agriculture and related sciences, English, mathematics, and history, and 3 hours on the farm, in the shop, or the laboratory was decided upon. One-fourth of the students will be required to remain on the farm during the summer vacation and will receive compensation for their work. A course of study prepared by Prof. J. S. Stewart, of the State university, and D. J. Crosby, of this Office, was recommended.

Rothamsted Station.—The following note regarding the station is copied from *The Gardeners' Chronicle:* "The Rothamsted Experimental Station (Laws Agricultural Trust) has received a donation of £2,000 from the Permanent Nitrate Committee, to be invested and added to the general endowment fund of the station. A donation of 100 guineas [about $500] has also been received from the Fertilizer Manufacturers' Association.

"During the past summer the station entered into occupation of the 'James Mason' Bacteriological Laboratory, the gift of Mr. J. F. Mason, M.P. The society for extending the Rothamsted experiments, which was formed to obtain funds wherewith the experimental station might enlarge the scope of its work and initiate further agricultural investigations, has further received during the past year subscriptions and donations amounting to £240. Further subscriptions are still urgently needed to secure a more adequate staff, and may be addressed to the secretary of the Rothamsted Experimental Station, Harpenden, Hertfordshire."

Agricultural Measures before Congress.—A bill has been recently introduced by Senator Clay and Representative Adamson, providing an annual appropriation of $2,500 for branch agricultural experiment stations. These stations are to be established under the direction of the stations now in existence, and the appropriation can be applied only to the expenses of conducting or verifying experiments bearing directly on agricultural industry.

A similar bill has been introduced by Representative Davis, which includes in addition an annual appropriation for industrial education in agricultural high schools and in city high schools.

Other measures recently introduced include bills authorizing experimentation by the Secretary of Agriculture in reference to cotton bollworm and cotton wilt disease; to prohibit the transmission of interstate or foreign messages regarding the buying or selling of "futures" in agricultural products or commodities; to provide for a soil survey in Hawaii; to establish a National wood-testing laboratory; to provide for the investigation of the water resources of the United States; to appropriate $100,000 for the establishment of demonstration farms, for the investigation of farm practice, and the inauguration of systems of farm management; to provide for fixing uniform standards of classification and grading of grain; to provide for the establishment of an agricultural bank in the Philippines; to refund 30 per cent of all money received from forest reserves to the respective States or Territories, for the benefit of the public schools and roads; to prevent the sale of adulterated and misbranded seed; to provide for the printing of 250,000 copies of the special report on the diseases of the horse; to aid in the settlement and irrigation of lands included in National reclamation projects, by setting aside 40 acres of land in each case for experiments in irrigation and drainage; and providing for the control of grazing upon the public lands.

Rosenbaum Live Stock Prizes.—Special prizes offered at the International Live Stock Exposition by Rosenbaum Brothers & Co., of Chicago, have been awarded, according to the winnings at the exposition of exhibitors from the

various States, to their respective stations, as follows: Illinois first, \$500; Indiana second, \$300; and Iowa third, \$200. These awards are to be used as prizes on live stock or to successful students in judging live stock and grain at the short winter courses.

Horse Breeding in Japan.—*Farmers' Advocate and Farm Journal* notes the formation of an organization, with headquarters at Tokyo, for the purpose of promoting improvement in the quality of Japanese horses. Half the shares in the company are in the hands of the government, which makes an appropriation for that purpose. Private capital promptly oversubscribed its portion of 150,000 yen (about \$150,000). Importations have been begun and competitions and public demonstrations are to be arranged.

Agricultural Fraternity.—*Farm Students' Review* states that the students in the college of agriculture of Ohio State University, with the approval of members of the agricultural faculty, have established a fraternity, *Delta Theta Sigma*, to stand strictly for advancement in agriculture and extend its development.

Necrology.—On October 26, 1906, Johann Dzierzon, one of the oldest and most famous investigators in the line of apiculture, died in Silesia at the age of 96 years. In many respects he was the Nestor of bee raisers and suggested many practical devices which are not always associated with his name, among them a separable hive similar to that invented by Langstroth about the same time. He is chiefly known throughout the world, however, on account of his announcement, in 1853, of parthenogenesis in bees. Much controversy has developed around this point in late years, but Dzierzon's theory has received substantial support from the majority of investigators.

William Warfield, a famous American breeder of Shorthorn cattle, and the author of one of the standard treatises on breeding animals, died recently in his eighty-third year.

Dr. Walter J. Sykes, for the last 15 years editor of the *Analyst*, died at Westfields, Grinstead, December 16, 1906, at the age of 64. He was educated in the medical profession but became interested in the chemistry of brewing, to the literature of which he made a number of contributions, notably The Principles and Practice of Brewing, the second edition of which is now in press. Among his investigations were studies of differentiation of various nitrogenous constituents of malt wort, and, together with C. A. Mitchell, of the diastatic power of malt. As editor of the *Analyst*, he was the author of a number of educational papers of value, and took a prominent part in popularizing the work of Hansen on yeasts and Emil Fischer on sugars.

Miscellaneous.—The opening of the agricultural exposition in Paraguay has again been postponed, and will take place March 31.

Pioneer Mail states that a new government farm wholly for tobacco research is to be opened in Rangpur district of Bengal, one of the most important tobacco-raising areas in India.

Kew Bulletin announces that Capt. A. T. Gage has been appointed superintendent of the Royal Botanical Gardens of Calcutta and director of the botanical survey of India.

Sidney Wells, principal of the Battersea Polytechnic, has been appointed director-general of the department of agriculture and technical education for Egypt. This department has been created to develop, organize, and control technical education in Egypt, and will be concerned with the government educational institutions of every kind, and also with the nongovernment technical institutions.

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EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, Ph. D., *Assistant Director.*

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NOTE.—The publications of the United States Department of Agriculture, except those of the Weather Bureau, may be purchased from the Superintendent of Documents, Washington, D. C. For the publications of the Weather Bureau requests and remittances should be directed to the Chief of the Bureau. The price of the Record is $1 per volume, or 10 cents per number. The prices of other technical publications are given in the list above. The publications of the State experiment stations are distributed from the stations and not from the Department.

EXPERIMENT STATION RECORD.

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Breeding as an art is perhaps as old as agriculture itself; certainly notable results were secured in the early ages. But efforts to put breeding on a scientific basis are very modern. The recent republication of Mendel's discoveries has given a great impetus to the systematic and thorough study of heredity and its practical bearings on animal and plant production, and there is now active and widespread interest in the subject of breeding in its scientific aspects.

In this country the movement is being fostered by the American Breeders' Association, whose purpose is stated in its constitution to be "to study the laws of breeding and to promote the improvement of plants and animals by the development of expert methods of breeding." This association was organized in 1904, and has held four regular meetings which were largely attended by the leading investigators and many practical breeders. The proceedings of the first three meetings have been published in two volumes, and comprise over one hundred and forty addresses and scientific papers relating for the most part to the theory of animal and plant breeding. A synopsis of the fourth meeting, recently held at Columbus, Ohio, is given elsewhere in this issue (p. 693). Taken together, these reports contain the best that is known in breeding, and furnish a basis for the revision of much that is contained in the treatises now used as text-books in the agricultural colleges.

The advantages of such an association in promoting and developing investigation in this important subject are very great. The subject is comparatively new as far as systematic investigation is concerned, and we have need of all the light that can come from associated effort and experience. The association has taken up the subject in a systematic manner, a large number of committees being authorized at the meeting in 1906 to look after various phases of animal and plant breeding. General problems were assigned to thirteen distinct committees, while fifteen others were to undertake the study of special problems relating directly to animal breeding, and a like number the problems of plant breeding. The membership of these committees includes some of the foremost investigators of the country.

Many of these committees have perfected their organization, accomplished considerable work of a preliminary nature, and are now actively engaged upon the duties assigned them, as indicated by the reports of progress presented at the recent meeting.

The present popularity of plant breeding is clearly evidenced by the large number of projects presented for investigation under the Adams fund. These probably exceed in number those proposed in any other single subject, but the wide range and grade of these undertakings indicate some misconceptions as to the research character of some of this work.

These projects may be classified somewhat roughly as follows: (1) Those which aim at "improvement" in a vague and indefinite way; (2) those which propose improvement and adaptation along rather more definite lines, through selections made from the crops in the field by eliminating the poorer groups rather than by isolating the superior individuals; (3) systematic breeding and selection, starting from the individual; (4) development of resistance to disease, insect attacks, hardiness, etc., by selecting individuals wherever found; (5) improvement through crossing and hybridizing, to be followed by systematic and rigorous selection; and (6) investigations into the laws of inheritance and variability, study of the correlations of vegetative parts with certain qualities, etc., to secure a basis for generalizations on the principles of breeding.

These classes evidently differ quite widely from a scientific standpoint and in the contribution they may be expected to make to our knowledge of breeding. The question is, Where should the line be drawn between the work of the plant breeder as an expert and investigator on the one hand and that of the seedsman and nurseryman on the other? There is a marked tendency among a certain class of men to regard the mere production of things, the general improvement of a plant or an animal in some respect, as research, wholly apart from any plan of adding to what we know about breeding and the laws governing it. These efforts consist in the adaptation of a plant to new environment, improving it in resistance to drought, earliness, productiveness, its composition with respect to some valuable constituent, and various qualities which go to make up excellence. Sometimes the plan does not even go so far as to designate the special line of improvement, and to this extent is aimless; and between this and the more specific and detailed plans of operations there are all gradations. Such work will usually not be along well-defined lines and methods, and unless it is carried out more carefully than the plan is outlined, it can be expected to add nothing of value to our methods.

Desirable as such work may be from a purely practical standpoint, it is difficult to see how it can be regarded as investigation in any true sense, and there is even doubt as to whether it is not more properly

the work of seedsmen and nurserymen than of an experiment station. Its real purpose is the attainment of material ends, the finding of something which is better, and it is not undertaken with a view to learning why certain results follow, and whether they are chance occurrences or in accordance with a general law and may serve as a safe basis of procedure. It is argued that we shall learn considerable from such work incidentally, but it seems very doubtful whether a man who is content to start out with a project which avowedly aims only at skillful improvement in an empirical way will often give himself much concern with incidental occurrences, whose study would delay him in his haste to attain a purely utilitarian end. Indeed, it may be questioned whether such work is often undertaken in the true scientific spirit.

It is the man who couples with his plan for improvement the purpose to add something to our knowledge, at least to the extent of knowing exactly how his end was attained, who will observe closely those specimens which do not come up to his requirements as well as those that do, will study the course of development carefully, and will thus learn something of the limitations and the idiosyncrasies of the supposed laws or rules.

Happily for the development of breeding as a science, a considerable number of projects have been undertaken which deal primarily or in part with the scientific aspects of the case. This is an encouraging tendency, and indicates something of a revolt from routine improvement work. More of the breeding work which now seems to be aimed at results without reference to the factors influencing their origin might be made to contribute toward the working out of certain principles if planned with reference to that end, and it seems extremely desirable that men who are engaged in this improvement work should take this feature into account.

Many have taken up breeding work without adequate preparation for it, and see in it only the possibility of "creating" something useful. Surely if anything more than the manipulative skill of the commercial breeder is claimed for this work, if it is to be regarded as appropriate for a station expert or an investigator, it should be undertaken with a full knowledge of the status of our information, so that advantage may be taken of the progress already made and of the most advanced thought in that field. Only in this way is the breeder equipped to observe intelligently and to correlate his observations in a way to be helpful.

One of the first requisites is accurate observation and the keeping of complete records. It is said that the only record of many new varieties is in the memory of the originator. The mere weeding out of those individuals which do not come up to the ideal standard, without any record as to their prevalence or characteristics, makes

the results useless for a study of inheritance and variability; but how important for this purpose might be a study of the reversions and the causes which lead to them.

Certain supposed limitations in plant breeding are so often mentioned that they have become almost axiomatic. Among these are the incompatibility of earliness and prolificacy, of large size and number of parts, and the correlation of other qualities. There is opportunity for further observation on these points, and if this limitation is found to prevail, the physiological phenomena which determine this antagonism remain to be worked out. Moreover, the recent work of Bateson has cast a doubt on the limitations of selection as a means of fixing a type which is worthy of further investigation.

The study of mutations, as described by De Vries, seems a fruitful field for investigation. The old taxonomic idea of the fixity of species appears to be doomed to give way to a different concept. MacDougal has recently shown that plants can be so profoundly affected by chemicals as to lose their character sufficiently to result in the production of new forms. If this should be true it may result in a new method of plant breeding, and at all events it calls attention to the possible influence of certain environmental conditions. Fertilizers and soil conditions are known to have an effect on the composition of the plant as well as on the quality. The turnip has been found to be quite constantly influenced in composition in proportion to the deficiency of the soil in phosphoric acid, and in the case of cereals an attempt has been made to work out a method for ascertaining the fertilizer requirements of the soil on the basis of the composition of the crop grown.

The necessity of taking these matters into account when plants are being bred for increased protein, and of fully checking or controlling all conditions other than individuality which may cause changes, will be apparent. In the case of leguminous plants bred for increased protein content the possible effect of nitrogen assimilation as a disturbing factor should be borne in mind. It has been shown that nitrogen assimilation may have the effect of increasing the nitrogen content of the plant or its seed, and it has also been found that plants apparently vary considerably in the energy with which they assimilate atmospheric nitrogen.

The conditions surrounding this activity and the factors which influence it are little understood, but these differences in conditions or capacity of the plant may nullify the results of breeding work which does not take account of them. The obvious remedy would seem to be the treatment of the soil in which these experiments are made in such way as to eliminate nitrogen assimilation and its attendant influences.

There is every reason why the breeding work as a whole should be placed upon a more scientific basis. It has become a prominent feature of the work of the stations, and the practical results attained have aroused interest and confidence in it. Already attention is being given by the more progressive farmers to selection, the use of improved seed, etc., and the work of the stations and others is therefore finding practical application in their hands. The greatest need of this work is improved methods and a better understanding of the principles involved, in order that observation may be guided and the interpretation of results made more sure.

With the retirement of Dean W. A. Henry from active service at the close of this year, the agricultural colleges and experiment stations will miss a very potent influence for development and an intelligent and enthusiastic advocate of their cause. For twenty-seven years Professor Henry has labored energetically and unceasingly for the recognition and upbuilding of agricultural education and experimentation, not only in his own State, but in a national way. His success has been an inspiration, and has gone a long way toward winning favor for agricultural instruction as well as pointing the way to reaching the farmers and their sons.

His career has characterized him as emphatically a man of action. All that he has achieved came through hard, persistent work. He believed in agricultural education and was determined to see its value recognized. If this could not be accomplished under the conventional method of teaching, he was ready to develop and test a new plan, and he had the courage of conviction necessary to carry it out in the face of doubt, if not opposition. And so he organized in 1886 the first successful short course in agriculture in this country; and when its success had been demonstrated he established the first dairy school in America in 1890. Four years later he started the ten-day course for adult farmers, which attracted one hundred and seventy-five men the first year, and was attended this year by six hundred and seven farmers.

He took a personal, individual interest in the students of these courses. He made special effort to follow their subsequent careers in order to study the benefits of the courses and means of strengthening them, and the success of these young men in a business way, as leaders in their communities, or in teaching, was a matter of the keenest gratification to him. In a very large measure the short course in agriculture is an institution of his making, and in later years he has turned his attention to the development of the long course and postgraduate work. He also interested himself in agricultural instruction through secondary schools, and had a part in the establishment of agricultural high schools in Wisconsin.

Professor Henry's success was no less marked in the development of the experiment station. He went to the University of Wisconsin in 1880 as professor of botany and agriculture, and three years later secured funds for the establishment of the experiment station. He had a thorough appreciation of scientific work and was keenly alive to the needs of the farmer. Step by step he developed different departments of the work, gathering around him a competent corps of workers, who were inspired by his enthusiasm and aided by his intelligent insight into the practical and scientific bearing of their work. Under his direction the Wisconsin Station has placed to its credit some of the most noteworthy contributions to the science of agriculture, and a multitude of results of practical importance, which the institution has carried directly to the farmer.

The imposing array of buildings which he has brought together at the University of Wisconsin, several of them the first of their kind to be erected at any agricultural college, will remain a tribute to his long period of service and to the confidence he inspired in the people of his State. Although not yet fifty-seven years of age, his health has been impaired by constant devotion to his work, which left little time for vacation. The letters of President Van Hise and of the board of regents in accepting the resignation, which he had been prevailed upon to postpone for some time, expressed a profound appreciation of Profesor Henry's services to the university and to the State, and a deep sense of personal loss at his going. The title of "emeritus professor" was conferred upon him.

In the closing paragraph of his letter Professor Henry says: "My work has been that of a pioneer. I have laid only the foundations; others will build a better superstructure than I possibly could . . . It is my hope, as it is my ambition, that when the load of responsibility is removed and I have somewhat regained my old-time health and vigor I can draw closer than ever before to our students and the farmers, and so in some ways at least be more useful than ever before." His many friends the country over will echo this hope, and will wish for him many years of continued activity in a less responsible and exacting capacity as a reward for his great service.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

Principles and practice of agricultural analysis, H. W. WILEY (*Easton, Pa.: The Chemical Pub. Co., 1906, vol. 1, 2. ed., rev. and enl., pp. XII+636, pls. 18, figs. 55*).—It is stated in the preface that "so rapid has been the advance of agricultural science that in the preparation of the second edition of this volume it has been found necessary to practically rewrite it. A considerable part of the contents of the first edition of this volume relating as much, if not more, to fertilizers than to soils, has been transferred to the second volume, but new matter more than equivalent thereto in bulk has been inserted. The latest improved methods have been described, in so far as they are based on new principles or have secured better results. An attempt has been made to bring out more fully the principles of procedure involved in order that the present volume might not only mirror the latest advances in science, but also, to some extent, reflect the philosophy of method and practice. To this end, many of the older methods, long out of vogue, are retained, because in them are found the beginnings of fundamental procedures which serve to unify the processes of analysis and render more intelligible the modern methods."

The bacteriological method in chemical research, W. OMELIANSKI (*Arch. Sci. Biol. [St. Petersb.], 12 (1906), No. 3, pp. 224-247*).—Reviewing the rapid progress which has recently been made in bacteriological investigation, the author suggests that in view of the intimate relation which exists between bacteriological and chemical reactions it is time that this alliance was realized in the establishment of a science of micro-biological chemistry similar to physiological chemistry, technical chemistry, etc. He points out that heretofore the bacteriological method has been used to study almost exclusively the natural processes of transformation of matter notwithstanding the fact that it has enriched chemistry by a series of perfectly new reactions and transformations. He is convinced that the sciences of chemistry and bacteriology should be united and that both will be advanced thereby, chemistry by being furnished with a new source of reagents and reactions, and bacteriology by having the aid of chemistry in solving a large number of very complicated chemical problems.

The duty of chemistry to agriculture, C. G. HOPKINS (*Illinois Sta. Circ. 105, pp. 27*).—This is the address of the president of the Association of Official Agricultural Chemists delivered at the annual convention at Washington, D. C., November 8, 1906.

On chemical examinations of arable soils, C. G. EGGERTZ (*Meddel. K. Landtbr. Akad. Exptlfält. [Stockholm], 1906, No. 91, pp. 1-62; K. Landtbr. Akad. Handl. och Tidskr., 45 (1906), No. 3-4, pp. 177-236; abs. in Centbl. Agr. Chem., 35 (1906), No. 12, pp. 793-799*).—The author gives a general discussion of methods of soil analysis and considers at some length the appearance and importance to plants of the various mineral constituents of the soils.

The method of analysis of solutions obtained by means of strong acids is severely criticised, the following method being used in the author's investigations here reported: At least 1 kg. of the soil in its natural condition, calculated on a water-free basis, is shaken for an hour with 2 liters of a 2 per cent hydrochloric-acid solution in a rotary apparatus of similar construction as, but of larger dimensions than, the Wagner apparatus for determination of citrate-soluble phosphoric acid in Thomas phosphate, and 1 liter filtered off. This amount is then evaporated to dryness to separate out silica and the ordinary course of analysis followed for the determination of the other constituents. Nitric acid is determined in a separate sample which is digested with water and the filtrate examined by the Ulsch method. Ammonia is determined in a sample digested with water acidulated with sulphuric acid. Organic nitrogen is determined according to the Kjeldahl method.

It was found that soils treated with a 4 per cent, and even a 2 per cent, hydrochloric-acid solution become sterile for the time being for all crops experimented with except potatoes, which can make a sickly growth therein. The reason why barley, at least, does not find sufficient food in the soil extracted in this manner is that soil so treated contains too little lime. During the second to fourth year after extraction, potatoes, oats, and barley develop much more luxuriantly in extracted soil than in a good arable soil, the explanation given being that the available plant food the first year is removed by the acid digestion and subsequent washing with water, whereas new plant food is formed later on from the organic raw material which remained in the soil. The nitric and sulphuric acids in the soil, in the author's opinion, are obtained from organic material, and phosphoric acid from phosphorus in humus substances.—F. W. WOLL.

Quantitative determination of potassium, R. PAJETTA (*Gaz. Chim. Ital., 36 (1906), II, pp. 150–156; abs. in Jour. Soc. Chem. Indus., 25 (1906), No. 21, p. 1068*).—The author finds that Tarugi's persulphate method of determining potash is inaccurate on account of the solubility of the potassium persulphate in solutions of sodium sulphate.

The solubility of gypsum in phosphoric acid solutions, W. C. TABER (*Jour. Phys. Chem., 10 (1906), p. 593; abs. in Chem. Abs., 1 (1907), No. 1, p. 21*).—It was found that at a temperature of 25° the solubility of gypsum increased with the concentration of the phosphoric-acid solution until a maximum was reached at about 230 gm. of phosphorus pentoxid per liter, when the solubility was about four times that in pure water. Beyond this point the solubility regularly decreased with the increase of the acid content.

The detection of nitric and nitrous acids, H. W. WAGNER (*Pharm. Centralhalle, 48 (1907), No. 1, pp. 5–7*).—The thymol, resorcin, and especially the phenol reactions for these acids are described.

Nitron: A new reagent for nitric acid (*Merck's Ann. Rpts., 19 (1905), pp. 151, 152; abs. in Chem. News, 94 (1906), No. 2454, p. 271*).—A description is given of the composition, properties, and method of use of this reagent. (See also E. S. R., 16, p. 945.)

Determination of nitrates, F. S. SINNATT (*Proc. Chem. Soc. London, 22 (1906), p. 255; abs. in Analyst, 31 (1906), No. 369, p. 418; Jour. Soc. Chem. Indus., 25 (1906), No. 24, p. 1227; Chem. Abs., 1 (1907), No. 2, p. 149*).—Knecht and Hibbert's method for picric acid was applied to the determination of potassium nitrate with a fair degree of accuracy. The method depends on the conversion of the nitrates into picric acid by means of phenolsulphonic acid, the picric acid being determined by titanium trichlorid.

On the distillation of ammonia with and without condensing in the Kjeldahl method of determining nitrogen, E. PESCHECK (*Jour. Landw., 54*

(1906), No. 4, pp. 367–384).—This article reports a number of studies of factors determining the accuracy of this method, especially the solubility of the alkalis of the glass apparatus and loss of ammonia. With Jena glass apparatus there was no considerable error due to solubility of alkalis of the glass. By use of proper precautions the loss of ammonia need not be considerable, although it can not be entirely prevented in distillation without cooling. In general, however, the method of distillation without a condenser gave substantially the same results as in case of the use of a condenser.

The determination of ammonia in water by Nessler's reagent, A. BUISSON *(Compt. Rend. Acad. Sci. [Paris], 143 (1906), No. 5, pp. 289–291; abs. in Bul. Soc. Chim. Paris, 3. ser., 35 (1906), No. 24, p. 1320).*—According to the author's investigations the precipitate obtained with Nessler's solution in weak solutions of ammonia (6 mg. per liter) has the following formula: $Hg_9N_4I_6$, a brown amorphous body insoluble in neutral solvents, but soluble in potassium iodid, which in excess liberates all the nitrogen in the form of ammonia as follows: $Hg_9N_4I_6+12KI+12H_2O=9\ HgI_2+4NH_3+12KOH$. All of the ammonia is not precipitated, the proportion being determined by various conditions of temperature, dilution, preparation of reagents, etc. In the author's experiments as much as 21 per cent of the ammonia escaped precipitation.

The Volhard method for the determination of chlorin in potable waters, F. T. SHUTT and H. W. CHARLTON *(Trans. Roy. Soc. Canada, 2. ser., 11 (1905–6), Sec. III, pp. 67–71; abs. in Chem. News, 94 (1906), No. 2453, pp. 258–260).*—Comparisons of the Volhard and chromate methods on a large number of samples of water are reported, the results showing that the Volhard method while less rapid than the chromate is more satisfactory for waters containing very small amounts of chlorin.

Table of the principal physical and chemical constants of fats, D. SIDERSKY *(Indus. Lait. [Paris], 31 (1906), No. 48, pp. 775, 776).*—Constants for 28 fats and oils of animal and vegetable origin calculated from compiled data are reported in tabular form.

A new method for the determination of casein in cheese, A. TRILLAT and SAUTON *(Bul. Soc. Chim. Paris, 3. ser., 35–36 (1906), No. 23, pp. 1207–1210).*—This is a direct method for the determination of casein in cheese, based upon the same principle as the method for the determination of casein in milk previously noted (E. S. R., 18, p. 9). The method is believed to show accurately the amount of proteids in cheese which have not undergone transformation during the process of ripening.

In applying the method to commercial samples, the following percentages of casein were obtained: Camembert, 18.20; Gruyère, 31.34; Gervais, 6.42; Brie, 22.93; Roquefort (half ripened), 11.65; Roquefort (well ripened), 7.10; and Holland, 31.50.

The classification of animal and vegetable proteids in relation to their products of decomposition, J. H. MILLAR *(Trans. Guinness Research Lab., 1 (1906), pt. 2, pp. 149–166).*—A summary and discussion of data with a view to classification of proteids.

Concerning glutamins, E. SCHULZE *(Landw. Vers. Stat., 65 (1906), No. 3–4, pp. 237–246).*—The author notes that there is considerable variation in the reported measurements of the optical activity of glutamin. A number of such measurements made with glutamins of known origin are reported and compared with the author's earlier work and with that of other investigators. In his opinion, it is not improbable that the variations are due to the existence of glutamins in stereoisometric forms.

On the liberation of phosphorus from nuclein compounds, F. H. SCOTT (*Brit. Med. Jour., 1906, No. 2399, pp. 1791, 1792*).—In a paper presented at the Toronto meeting of the British Medical Association (1906), the author reports studies of the phosphorus in nuclein compounds. As a whole his investigation shows "that it is much more difficult to cause the phosphorus to pass from its nucleic-acid combination to an inorganic condition than was previously supposed. The whole principle of the Lilienfeld-Monti-Macallum reaction is therefore wrong, and we must conclude, with Raciborski and Bensley, that the deductions drawn from its use are worthless in so far as they relate to nucleic acid."

On the effect of the volume of the lead precipitate in cane sugar analysis, N. DEERR (*Internat. Sugar Jour., 9 (1907), No. 97, pp. 13–15*).—The following conclusions are drawn from the results of experiments:

"Solutions of cane products when made up to different volumes in the presence of the lead precipitate tend to give nearly identical polarizations, when the readings are made at different concentrations.

"This effect is due to the compensating effect of the volume occupied by the lead precipitate and the increase in specific rotation with dilution.

"The lead precipitate has an effect on the polarization, and neglect of this tends to give a plus error to observations made under the conventional method of analysis."

The chemical composition of the crude fiber of sugar cane, H. C. P. GEERLIGS (*Meded. Proefstat. Suikerriet West-Java, 1906, No. 91, pp. 20*).—The crude fiber portion of a number of samples of sugar cane of different varieties was studied and its constituents determined.

The furfurol and methylfurfurol-yielding constituents of lignocellulose, K. FROMHERZ (*Ztschr. Physiol. Chem., 50 (1906), No. 2–3, pp. 209–240, pl. 1*).—The investigations which were made with the lignocellulose of aspen wood are a contribution to the chemistry of cellulose.

Determination of mineral acids in vinegar, F. W. RICHARDSON and J. L. BOWEN (*Jour. Soc. Chem. Indus., 25 (1906), No. 17, pp. 836–838*).—A modification is described of the Hehner method of estimating sulphuric acid in vinegar, which the authors claim increases decidedly the accuracy of the results.

The fuller's earth test for caramel in vinegar, W. L. DUBOIS (*Jour. Amer. Chem. Soc., 29 (1907), No. 1, pp. 75–77*).—Such great variations were obtained in tests of fuller's earth of different sorts for removing coloring matter from samples of cider vinegar of known purity that the author believes the material should not be employed in analytical work for removing coloring matter except in preliminary tests.

METEOROLOGY—WATER.

Climatology of the United States, A. J. HENRY (*U. S. Dept. Agr., Weather Bur. Bul. Q, pp. 1012, pls. 33, figs. 7*).—The primary object of this work is stated to be "to present in form for easy reference comparative climatic statistics for the different portions of the United States. The need of such a volume has been felt for some time, particularly within the Department."

In general the statistics presented cover the period from 1870 to 1903. "Two distinct series of observations have been used: First, the observations made primarily for the synoptic weather charts during the period 1870 to 1903; second, the observations made by voluntary observers of the U. S. Weather Bureau for purely climatic purposes. . . .

"The first chapter deals with the broader features of the climate of the United States. It is intended to be read in connection with reports on the climate of the respective States, which appear in subsequent chapters. For convenience in

grouping and discussion the country has been divided into six climatic districts, viz, the New England and Middle Atlantic States, the South Atlantic and East Gulf States, the West Gulf and Southern Rocky Mountain Slope, the North Central States, the Rocky Mountain and Plateau region, and the Pacific coast."

Data regarding location, equipment, and climate are summarized for each station in these districts.

Forty years of southern New Mexico climate, J. D. TINSLEY (*New Mexico Sta. Bul. 59, pp. 43, figs. 5, dgms. 4*).—"This bulletin contains a record of the monthly and annual mean maximum, mean minimum, and mean temperatures, highest and lowest temperatures during each month, number of days with temperature of 32° or less, number of days with temperature of 60° or less, precipitation, relative humidity, condition of the sky, and wind movement for each month and year from 1892 to 1905, as observed at the New Mexico Experiment Station. Also, temperature and rainfall records for other stations in the Mesilla Valley for most of the years between 1851 and 1890.

"The data have a general application to those portions of southern New Mexico having an altitude less than 4,000 ft.

"The annual mean maximum temperature for 14 years is 76.8°. The annual mean minimum for 13 years is 41.4° and the annual mean for 40 years is 61.6°. The lowest temperature in 14 years was 1° in December, 1895, and the highest, 106°, which has occurred several times. Temperatures of 10° and less are not uncommon at night in December, January, and February.

"The mean annual range of temperature is 35.4°. The absolute monthly range is from 45° to 75°. The greatest annual range was 101° in 1895.

"The mean number of days in a year when the temperature does not rise above 60° is 56 and of the days when the temperature falls below 32° in the 24 hours is 121.

"The mean annual rainfall is 8.8 in. The smallest was 3.5 in. in 1873, and the largest, 17.1 in. in 1905. The most of the rain falls during July, August, and September. Snow occurs, but the amount is too small to be of economic importance.

"The records scarcely sustain the idea that there has been a permanent increase in the rainfall.

"The relative humidity is low, the annual mean being probably about 40 per cent. The mean monthly wind movement is about 5,000 miles, 7 miles an hour. The mean number of clear days per year is 225, part cloudy 91, and cloudy 49. The evaporation is 5 to 6 ft. per year."

World weather, J. ELIOT (*Sci. Amer. Sup., 62 (1906), No. 1614, pp. 25862, 25863*).—This is a quotation of a review of a memoir by this author, in which the belief is expressed that the results of investigations reported in the memoir have an important bearing on the practical work of forecasting. The statement is made that the investigations are of special importance because novel methods of studying air movement on a large scale were employed, "leading to results not merely unexpected, but opposed to the fundamental principles which have formed the chief stock-in-trade of meteorologists during the past fifty years."

Monthly Weather Review (*Mo. Weather Rev., 34 (1906), Nos. 9, pp. 405–452, figs. 9, charts 7; 10, pp. 453–504, figs. 7, charts 7*).—In addition to the usual reports on forecasts, warnings, weather and crop conditions, meteorological tables and charts for the months of September and October, 1906, monthly review of the progress of climatology throughout the world, recent papers bearing on meteorology, recent additions to the Weather Bureau library, etc., these numbers contain the following articles and notes:

No. 9.—The Relation of the Weather to the Flow of Streams, by F. H. Brandenburg; Phenomenal Rainfall at Guinea, Va. (illus.), by E. A. Evans; The

Green Sun of the Krakatoa Eruption; International Weather Cablegrams; The Zodiacal Light, by A. Searle; The Direction of Local Winds as Affected by Contiguous Areas of Land and Water, by T. H. Davis; Height of the Atmosphere Determined from the Time of Disappearance of Blue Color of the Sky after Sunset, by T. J. J. See; Pilot Balloons and the Upper Winds, by F. O. Hills; Professor Adolf Erman, by W. Erman; The Atmosphere and the Soil; The Classification of Climates; The West Indian Hurricanes of September, 1906 (illus.), by E. B. Garriott; Weather Bureau Men as Educators; Educational Notes; and Popular Meteorological Lectures in England.

No. 10.—Suggestions as to Teaching the Science of the Weather, by J. W. Smith; Abnormal Weather Over Southern Texas, by J. L. Cline; A Rare Cumulus Cloud of Lenticular Form (illus.), by H. H. Clayton; Do Climates Change? Climatological Data for Virginia; Land and Sea Winds; Reprints of Works on Meteorology; Premature Publication; Sonora Storms and Sonora Clouds of California (illus.), by A. Campbell; Has the Gulf Stream any Influence on the Weather of New York City? On the Formation of Anchor Ice, or Ground Ice, at the Bottom of Running Water, by H. T. Barnes; Weather Bureau Men as Educators; and Studies on the Thermodynamics of the Atmosphere—VIII, The Meteorological Conditions Associated with the Cottage City Waterspout—Continued (illus.), by F. H. Bigelow.

Meteorological observations, J. E. OSTRANDER and T. A. BARRY (*Massachusetts Sta. Met. Buls. 215, 216, pp. 4 each*).—Summaries of observations on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during November and December, 1906. The general character of the weather of each month is briefly discussed, and the December bulletin gives a summary for the year. The principal data in this summary are as follows:

Pressure[a] (inches).—Maximum, 30.95, February 11; minimum, 29.25, January 4; mean, 30.051. *Air temperature*[b] (degrees F.).—Maximum, 91, September 18; minimum, —7.5, March 24; mean, 47.3. *Humidity.*—Mean dewpoint, 38.6; mean relative humidity, 77.1. *Precipitation.*—Total rainfall or melted snow, 45.45 in.; number of days on which 0.01 in. or more rain or melted snow fell, 121; total snowfall, 56¼ in. *Weather.*—Total cloudiness recorded by sun thermometer, 1,794 hours, or 40 per cent; number of clear days, 130. *Bright sunshine.*—Number of hours recorded, 2,660, or 60 per cent. *Wind.*—Prevailing direction, west, northwest; total movement, 53,273 miles; maximum daily movement, 572 miles, February 28; minimum daily movement, 1 mile, February 14 and May 6; maximum pressure per square foot, 12 lbs., December 1, NNW. *Dates of frost.*—Last, May 20; first, September 25. *Dates of snow.*—Last, April 23; first, November 11.

Meteorological summary for 1905, C. A. PATTON (*Ohio Sta. Bul. 176, pp. 385–399*).—This summary includes as usual notes on the weather of each month and tabulated daily and monthly records of observations at the station at Wooster, Ohio, on temperature, precipitation, cloudiness, direction of the wind, etc., and for comparison, similar data for 18 previous years (1888–1905) at the station and for 23 years (1883–1905) in other parts of the State.

The mean temperature for the year at the station was 49° F.; for the State 50°; the highest temperature at the station 92°, July 17; for the State 100°, July 10; the lowest temperature at the station —12°, February 14; for the State —20°, February 3. The annual rainfall at the station was 24.93 in., for the State 39.02 in. The number of rainy days was 118 for both the station and

[a] Reduced to freezing and sea level. [b] In ground shelter.

the State at large. The prevailing direction of the wind was south at the station and southwest for the State. The most marked feature of this meteorological record is the deficiency of rainfall at the station in 1905, namely, 24.93 in. as compared with 38.9 as the average for 18 years. In contrast with this deficiency at the station is an average rainfall during 1905 of 39.02 in. for the State as compared with an average of 37.25 in. for 23 years.

Peruvian meteorology, 1892–1895, S. I. BAILEY (*Ann. Astron. Observ. Harvard Col., 39 (1906), pt. 2, pp. 155–286, pls. 4, figs 2; abs. in Science, n. ser., 24 (1906), No. 624, p. 785*).—Observations on temperature, pressure, precipitation, wind movement, cloudiness, etc., at 9 stations varying in altitude from 80 to 19,200 ft. are summarized.

Meteorology, E. J. VON DADELSZEN (*New Zeal. Off. Yearbook 1906, pp. 200–206*).—Monthly summaries are given of observations on temperature, rainfall, atmospheric pressure, and wind, throughout New Zealand at 12 stations during the year 1905.

Weather observation, A. MARTIN (*Queensland Agr. Jour., 17 (1906), No. 5, pp. 223–225*).—The importance of the farmer being a careful observer of weather conditions is pointed out and some simple rules for predicting weather are given.

The meteorological service of the Republic of Mexico, M. E. PASTRANA (*Bol. Sec. Fomento* [*Mexico*], *6 (1906), No. 2, IV, pp. 15–35*).—The history of the development and organization of this service, showing not only its present organization but its proposed extension, is discussed in this article by the director of the service.

Résumé of researches in the higher meteorology, F. H. BIGELOW (*George Washington Univ. Bul., 5 (1906), No. 4, pp. 23–35*).—The author briefly summarizes the present status of investigations which he has been carrying on for a number of years "to throw light upon the relations between the amount of the variable energy emitted by the sun and the corresponding changes in the circulation of the earth's atmosphere," the general features of this research being outlined under three heads, namely, "(1) the solar-terrestrial electric and magnetic fields, (2) the circulations of the atmospheres of the sun and of the earth, respectively, and their mutual relations, (3) the reconstruction of the observational data."

Storms and hail, E. DAGUILHON-PUJOL (*Jour. Agr. Prat. Vit. et Écon. Rurale Midi France, 102 (1906), No. 6, pp. 227–239*).—This is mainly a review of past experience in hail protection by means of cannonading, from which the conclusion is drawn that, if the organizations for hail protection will continue their trials and science will persist in its researches, very probably a time will come when agriculturists may be protected against hail.

Thunderstorms and the moon, C. W. HISSINK (*Hemel en Dampkring, 4 (1906), No. 5, pp. 78, 79; abs. in Science, n. ser., 24 (1906), No. 626, p. 866*).—This article reports a study of thunderstorm days in Holland for the period 1883 to 1903, showing so complete an agreement for different phases of the moon as to indicate a lunar influence on storms.

The sanitation of air, K. MEIER (*Pop. Sci. Mo., 70 (1907), No. 1, pp. 19–32*).—This article discusses the bearing of exhausted and contaminated air on health; the causes of impure air, including smoke, street dust, vitiation through heating, cooling, and ventilating apparatus, and various other causes in buildings, and vitiation through animal life; and suggestions for relief, including improvements in sanitation, ventilation, and constructon of buildings.

It is stated that the subject of the sanitation of air has been much neglected and as a result conditions still exist which might be greatly improved with com-

parative ease. Two of the chief causes of impure air in cities are smoke and street dust. The former can be greatly reduced by the elimination of steam-power transportation in urban and densly populated districts, which is asserted to be entirely unnecessary and should have long ago been prohibited. It is also asserted that the accumulation of street dust is inexcusable from the hygienic standpoint. The heating appliances now in general use are in many cases objectionable because they collect dust and disseminate it throughout the air in houses. Conditions in houses can be improved by seeing that all stoves and grates are connected with flues. The author is of the opinion that in general it is better to secure ventilation by natural means rather than by use of forced or mechanical ventilation.

The life history of surface air currents: A study of the surface trajectories of moving air, W. N. SHAW and R. G. K. LEMPFORT (*London: Wyman & Sons, 1906, pp. 107, pls. 26, figs. 20*).—The paths or trajectories of storms are worked out and platted from records of the air movement at a large number of stations in the area passed over by a series of typical storms, and the bearing of the results thus obtained on the movement of air into or out of storm areas and on the associated weather conditions is discussed.

Progress in the field of water investigation, L. KRAUSS (*Apoth. Ztg., 21 (1906), p. 846; abs. in Chem. Ztg., 30 (1906), No. 93, Repert. No. 46, p. 403*).

Springs in limestone regions and their quality for drinking purposes, H. SCHARDT (*Bul. Soc. Neuchâtel. Sci. Nat., 32 (1903–4), pp. 221–242*).—This is one of the reports provided for at the Thirteenth International Congress of Hygiene and Demography at Brussels in 1903, and discusses somewhat elaborately the conditions affecting the drinking quality of waters from limestone areas. The danger of imperfect filtration on account of fissures and underground channels is very clearly brought out and a strict examination and control of waters of this kind is shown to be an urgent necessity in order to insure their purity and safety.

Contribution concerning the purification of water by ozone, D. RIVAS (*Centbl. Bakt. [etc.] 2. Abt., 17 (1906), No. 14–16, pp. 506–517, figs. 6*).—The preparation of ozone by means of electrical discharges is described and experiments in Philadelphia in which the process was applied in the purification of water are reported.

The results lead to the conclusion that under favorable conditions ozone not only reduces the general bacteria content of water but also eliminates *Bacillus coli communis.* It also attacks objectionable organic matter in the water and oxidizes ammonia to nitrate. In water rich in organic matter, however, the germicidal and chemical action is only partial. With such water as is ordinarily obtainable for a city supply it is believed that very satisfactory results would be obtained by ozonization.

Control of water purification plants, VON COCHENHAUSEN (*Ztschr. Angew. Chem., 19 (1906), Nos. 48, pp. 1987–1993; 49, pp. 2023, 2024*).—A discussion of processes for removing lime and magnesia from water, and methods of determining combined carbon dioxid, lime, magnesia, and hardness in connection with purification plants.

A sand filter for the home, R. FLETCHER (*N. H. Sanit. Bul., 2 (1906), pp. 190–198; abs. in Chem. Abs., 1 (1907), No. 1, p. 77*).—The making and use of such a filter for purification of water for home use are discussed. The capacity of the filter described is about 40 gal. per day.

SOILS—FERTILIZERS.

A treatise on rocks, rock-weathering, and soils, G. P. MERRILL (*New York and London: The Macmillan Co., 1906, rev. ed., pp. XXI+400, pls. 31, figs. 42*).—The author states that in the preparation of this revised edition "many errors have been corrected, matter that proved nonessential eliminated, and a considerable number of new analyses and illustrations introduced."

Studies on the soils of the northern portion of the Great Plains region: The third steppe, F. J. ALWAY and R. A. GORTNER (*Amer. Chem. Jour., 37 (1907), No. 1, pp. 1-7*).—This is a continuation of studies previously noted (E. S. R., 18, p. 531) and deals with the region extending "from the Missouri Coteau westward to the Rocky Mountains or the bordering foothills, including the portions of Alberta and western Saskatchewan south of the North Saskatchewan River." The altitude of this region varies from about 2,000 ft. on the east to over 4,000 ft. at the foot of the mountains.

The soil is in general more sandy and gravelly than that of the second steppe, studies of which were reported in the previous article. "The surface soils are rich in nitrogen, potash, and lime, and are well provided with phosphoric acid. The subsoil differs in mineral constituents from the preceding chiefly in the much larger amount of calcium and magnesium carbonates and in a somewhat smaller amount of potash. Both contain considerable quantities of water-soluble salts, which in many places over the area have been partly leached out into the depressions, forming tracts of alkali lands."

Analyses of samples from each foot of the soil to a depth of 6 ft. are reported as well as of the water of Old Wives Lake, which is situated near the eastern edge of the steppe and serves as an evaporating basin for the drainage of a region covering about 5,000 square miles. Analysis of the lake water showed the presence of 27.3 gm. of solid matter per liter, the principal constituents being sodium, sulphuric acid, and chlorin, indicating that the principal salt present is sodium sulphate, with smaller amounts of sodium chlorid.

Attention is called to the fact that glass objects which have been exposed for some time to direct sunshine on the soils of this region assume a more or less intense violet coloration. It was thought that this might be due to the rather large proportion of manganese occurring in the soil, but further investigation indicated that it resulted from the presence of manganese in the glass itself.

Maintaining the fertility of rice soils—a chemical study, G. S. FRAPS (*Texas Sta. Bul. 82, pp. 42, figs. 4*).—This bulletin reports a study of the chemical composition and properties of some rice soils, rice irrigation waters, and of the rice plant itself, with the object of suggesting methods for maintaining the fertility of rice soils.

From the analyses reported it is estimated that an average Texas rice crop (producing 1,900 lbs. of rough rice per acre) requires 16 lbs. of phosphoric acid, 42 lbs. of nitrogen, and 55 lbs. of potash. Rice straw carries with it when removed 3 lbs. of phosphoric acid, 14 lbs. of nitrogen, and 31 lbs. of potash per acre. In burning rice stubble nearly 5 lbs. of nitrogen is lost and in burning rice straw 14 lbs. of nitrogen passes off. The ashes of the straw contain 3 lbs. of phosphoric acid and 37 lbs. of potash per acre.

"An average crop of rice consumes more nitrogen than an average crop of cotton, oats, or corn. If the rice straw is taken entirely away, the draft on the potash is four times as much as by cotton, oats, or corn. If the rice straw ashes are restored, the loss of potash is 5 lbs. per acre, about half as much as is removed by cotton, oats, or corn.

"On an average, 7.6 lbs. phosphoric acid, 1.4 lbs. nitrogen, and 23.4 lbs.

potash per acre are brought on the field by the irrigation water. This is not as much phosphoric acid, nitrogen, or potash as is consumed by a crop of rice. It is estimated that the seepage and off-flow waters carry off approximately 4.5 lbs. phosphoric acid, 3.4 lbs. potash, and probably larger amounts of nitrogen.

"The net result of the irrigation waters is thus an average gain of 3.1 lbs. phosphoric acid and 20 lbs. potash per acre, and a loss of nitrogen. A loss of approximately 20 lbs. nitrogen per acre by percolation during the winter may take place, with small amounts of potash and phosphoric acid.

"The soil loses, in the growth of an irrigated rice crop, on an average of 12 lbs. phosphoric acid, 60 lbs. of nitrogen, and 22 lbs. potash per acre, if the straw is removed and the stubble burned. If, however, the stubble is plowed under, and the straw ashes returned to the field they come from, there is an average loss of 9 lbs. phosphoric acid, 57 lbs. nitrogen, and apparently a gain of 15 lbs. of potash."

Of the soils examined those of Jefferson, Orange, De Witt, and Victoria counties, as well as the black soils of Brazoria, contained small quantities of phosphoric acid. Those of Harris County, the Rio Grande Valley, and the Brazos bottom soils of Brazoria contained an abundance of phosphoric acid. Orange County soil was low in potash, the others contained a moderate amount, while the Rio Grande Valley soil was rich in this constituent. The only soil low in lime was that of Orange County.

Nitrification studies indicate that the soils of Orange and Brazoria counties are too low in phosphoric acid for efficient nitrification. All the soils examined contained very small amounts of chemically available phosphoric acid as measured by fifth-normal nitric acid. The chemically available potash determined in the same way was low in the Brazoria and Orange county soils, but present in moderate amounts in other soils.

Regarding the treatment of rice soils, the author states that "burning the straw is wasteful, but if burned, the ashes should be scattered on the field from whence they came. The stubble should be plowed under if possible. The nitrogen content of the soil should be maintained by growing leguminous crops (cowpeas, vetch, etc.), which are plowed under with caution, grazed off, or made into hay."

Results of analyses of cultivated soils, F. F. Villaseñor (*Mem. y Rev. Soc. Cient. "Antonio Alzate," 23 (1905), No. 5–6, pp. 187–198; (1906), No. 7–12, pp. 389–394*).—Physical and chemical analyses of 9 samples of Mexican soils are tabulated.

A note on the protective action of colloids on suspended clay and natural clay soils, E. Fickendey and B. Tollens (*Jour. Landw., 54 (1906), No. 4, pp. 343–350*).—This article discusses the results of experiments in which 20 cc. of solutions of different colloids of varying concentrations was mixed with 1 cc. of kaolin suspension and twice-normal electrolytes of different kinds (potassium hydroxid, hydrochloric acid, etc.) were added. It was found that in such cases starch exerted no influence, but that tannin produced a marked effect in preventing flocculation (but only in alkaline solution), while the amphoteric gelatin exerted a positive influence in acid solutions and a negative influence in alkaline solutions. The greatest protective action was observed with about $\frac{1}{100}$-normal hydrochloric acid containing from 0.1 to 0.2 gm. of gelatin per liter.

The beneficial effect of lime on the structure of soils is explained on the basis of these results as due to the fact that lime forms insoluble compounds with the humus acids and that these compounds remain insoluble in spite of the alkaline reaction of the soil. It is claimed that the calcium ion is especially active in flocculations and that the flocculating power of ions bears a direct relation to their precipitation reactions.

The injurious effect of sodium nitrate on soil structure noted by Krüger (E. S. R., 17, p. 949) is ascribed to the fact that the sodium carbonate formed in the soil dissolves humus acids and interferes with the flocculation of clay particles.

An explanation of the physical terms used in the article is given by B. Tollens.

On the nitrogen compounds in cultivated soils, T. Pfeiffer and P. Ehrenberg (*Mitt. Landw. Inst. Breslau, 3 (1906), No. 5, pp. 899–927; abs. in Chem. Centbl., 1906, II, No. 21, pp. 1624, 1625; Chem. Ztg., 30 (1906), No. 93, Repert. No. 46, pp. 402*).—Parallel determinations of nitrogen by the two authors in 5 different types of soil before and after drying with and without addition of acid are reported and discussed with special reference to Warmbold's conclusions from similar investigations (E. S. R., 18, p. 16).

The conclusion is reached that in soil studies involving the nitrogen balance a large series of determinations is indispensable and it is preferable to have parallel series of determinations by two skilled analysts. Soil samples may be dried without loss of nitrogen when slightly acidified. The conclusion of Warmbold that sterilized soil fixes free nitrogen in considerable amounts was not confirmed.

In many soils the weighing of samples for air-dried material is not considered accurate.

On the nitrogen compounds in cultivated soils, T. Pfeiffer (*Fühling's Landw. Ztg., 55 (1906), No. 22, pp. 749–752*).—This is an author's abstract of the above article.

Evaporation and drainage from fallow, loam, and sandy soils, C. von Seelhorst (*Jour. Landw., 54 (1906), No. 4, pp. 313–315*).—Observations on drainage and evaporation from loam and sandy soils in large vegetation tanks from October, 1904, to March, 1906, are reported. These show, in general, that the evaporation was largest and the drainage smallest from the loam soil during the fall and winter. With sandy soils this was true in summer.

The drainage was, as a rule, larger and the evaporation smaller from the sandy soil than from the loam. The greater evaporation from the loam soil is attributed to lower percolation and greater capillary capacity in this soil. Greater evaporation from the sandy soil was observed only during a period of high temperature and heavy rainfall in summer.

Nitro-culture and inoculation, O. M. Ball (*Texas Sta. Bul. 83, pp. 15*).—Two series of pot cultures carried out during the winter and spring of 1904–5 and the fall of 1905 are reported.

"In the first series the object was to determine whether nodules will appear on the roots of alfalfa when this plant is grown in soils where none had ever before been cultivated, but which produced a fine growth of bur clover (*Medicago denticulata*), and, further, whether the nodules already present on the roots of bur clover could be carried over to alfalfa when grown in soil that had previously been sterilized; in short, whether artificial inoculation of alfalfa with the germs from bur clover is feasible. In the second series the question was to determine the value, if any, of the so-called nitro-culture and other like 'cultures.'"

A variety of soils was used in the first series, and the method of procedure was much the same in the two series of experiments. The first series showed in brief that alfalfa will become infected with the tubercle-forming organism (*a*) when grown in soil which has produced a crop of bur clover, (*b*) after being watered with a solution of such soil, and (*c*) by means of an infusion of the root nodules of bur clover. The results of the second series of experiments indicate that inoculation with nitro-culture is of doubtful value "since only a small proportion of the plants treated developed tubercles, and these were in no observable degree benefited by their presence. In no case of artificial inoculation were the

number and vigor of the tubercles so great as in that occurring by natural means."

The nutrition of cultivated plants, G. SMETS (*La Nutrition des Plantes Cultivées. Maeseyck: Vanderdonck-Robyns, 1905, 2. ed., pp. 272, figs. 2*).—This book summarizes briefly but clearly information drawn largely from the author's own work regarding the general laws and principles of plant nutrition and elaboration of plant food, the behavior of fertilizing substances in the soil, various kinds and classes of manures and fertilizers, fertilizer requirements of Belgian soils, and the use of fertilizers on different kinds and classes of crops and soils. Numerous references to accounts of investigations upon which the book is based are given.

The management of stable manure in the heap, A. STUTZER (*Fühling's Landw. Ztg., 55 (1906), No. 13, pp. 436–442, figs. 4*).—A general discussion of this subject.

On storage of liquid manure (*Ber. K. Vet. og Landbohöjskoles Lab. Landökonom. Forsög [Copenhagen], 60 (1906), pp. 140–142*).—Experiments on conservation of liquid manure were conducted in connection with the investigation of the protein minimum for dairy cows, reported elsewhere (E. S. R., 18, p. 668). Sulphuric acid or peat litter in different quantities was added to definite amounts of urine and the mixture left standing in glazed crocks or in bottles for about six months. The nitrogen content was determined at the beginning and the end of the trials. The losses of nitrogen obtained were as follows: 1,000 gm. urine alone, 79.5 per cent; urine and peat litter, 5:1, 62.4 per cent; 1:1, 17.7 per cent; 1:2, no loss; 1:3, 1.8 per cent; urine in a stoppered bottle connected with a bent glass tube, the other end of which was placed under sulphuric acid, no loss; urine left standing under similar conditions as in last experiment, except that the tube was not sealed by sulphuric acid, but was left open, no loss.

The practical deduction drawn from the experiments is that a liquid-manure cistern should be made water-tight and closed with a tightly fitting cover which will prevent escape of ammonia in the air above the liquid.—F. W. WOLL.

Value of moss litter (*Jour. Bd. Agr. [London], 13 (1906), No. 6, pp. 360, 361*).—Tests of the absorbent capacity and value as litter for stables of this material are briefly reported, the high absorbent capacity of the material for both nitrogen and water being clearly shown. Manure with which this litter was used was apparently quicker in action than that with which straw was used.

Water as a plant food, A. BACKHAUS (*Verhandl. Gesell. Deut. Naturf. u. Aerzte, 1905, II, 1. Abt., pp. 123–127; abs. in Chem. Centbl., 1906, II, No. 18, p. 1453*).—See also E. S. R., 17, p. 1055.

Artificial manures in Japan (*Abs. in Jour. Soc. Chem. Indus., 25 (1906), No. 19, p. 942*).—Data are reported showing that the demand for fertilizers in Japan is very active, prices rising, and production increasing. The imports consist mainly of ammonium sulphate, oil cake, and phosphates. The greater part of the sardines caught in Japanese waters, valued at about $3,650,000, are ultimately used as manure. (See also E. S. R., 17, p. 1140.)

Report on commercial fertilizers, 1906, E. H. JENKINS, A. L. WINTON, ET AL. (*Connecticut State Sta. Rpt. 1906, pt. 1, pp. 106*).—Analyses of 559 samples of commercial fertilizers and manurial waste products examined during the year are reported and discussed with reference to variation in composition and commercial value. The fertilizers examined are classified as follows: Containing nitrogen as the chief valuable ingredient, 118 samples; containing phosphoric acid as the chief valuable ingredient, 11 samples; containing potash as the chief valuable ingredient, 39 samples; containing nitrogen and phosphoric acid,

55 samples; mixed fertilizers, 278 samples; and miscellaneous fertilizers and manures, 58 samples.

Fertilizer inspection, C. D. Woods and J. M. Bartlett (*Maine Sta. Bul. 133, pp. 177–208*).—"This bulletin contains the analyses of samples collected by the station of the brands of fertilizers licensed in 1906."

Commercial fertilizers, H. J. Wheeler et al. (*Rhode Island Sta. Bul. 115, pp. 15*).—"In this bulletin will be found analyses of such potato and vegetable fertilizers as have been found on sale in Rhode Island during the spring of 1906, also analyses of similar samples of bone and tankage."

Analyses of commercial fertilizers, B. L. Hartwell et al. (*Rhode Island Sta. Bul. 117, pp. 37–52*).—This is a second report on inspection of fertilizers in 1906, and includes analyses and valuations of 85 samples of fertilizing materials.

Commercial fertilizers and chemicals, T. G. Hudson, J. M. McCandless, et al. (*Bul. Ga. Dept. Agr., 1906, No. 43, pp. 136*).—This is a report on inspection of fertilizers on sale in Georgia during the season of 1905–6, including the text of the fertilizer and pure food laws of the State, regulations regarding conduct of inspection, notes on valuation, and tabulated analyses and valuations.

A test of nine phosphates with different plants, H. J. Wheeler and G. E. Adams (*Rhode Island Sta. Bul. 114, pp. 115–137*).—The experiments reported in this bulletin were begun in 1894 and have been partly reported upon in a previous bulletin (E. S. R., 11, p. 642).

The experiments were made on limed and unlimed series of plats ($\frac{2}{15}$ acre), which from 1894 up to the date of the experiments here reported had at different times (1894, 1895, 1899) received applications of dissolved boneblack, dissolved bone, acid phosphate, double superphosphate, floats, fine-ground bone, basic slag, and raw and roasted redondite, aggregating in the majority of cases 98.5 lbs. of phosphoric acid per plat, or at the rate of 738.6 lbs. per acre. The bulletin reports experiments on these plats with corn in 1900 and with a large variety of other crops, including potatoes, barnyard grass (*Panicum crus-galli*), oats, millet, soy beans, Adzuki beans, peas, squashes, turnips, cabbage, crimson clover, and beets, in 1901. In every case the phosphates were used in connection with a liberal basal fertilizer consisting of nitrate of soda and potash salts.

In the case of corn all the phosphates were as a rule more effective on limed than on unlimed soil. Raw redondite was much less effective than roasted on limed soils, while the two were of about equal efficiency on unlimed soil. Floats gave good results in these experiments, although the material was very inefficient on corn the first year it was applied. The results with double superphosphate showed very low efficiency on unlimed soils, and dissolved boneblack gave "exceptionally poor results," which it is suggested were possibly due to the effect of drought, which was especially severe on the plats on which this material was used.

"With the pea, oat, summer squash, crimson clover, Japanese millet (on the unlimed land), golden millet, white-podded Adzuki bean, soy bean, and potato (on the unlimed land) floats gave very good results; but with the flat turnip, table beet, and cabbage they were relatively very inefficient, notwithstanding that much more phosphoric acid had been applied in the floats than in any other of the phosphates.

"In the case of the pea, oat, summer squash, crimson clover, Japanese millet, golden millet, cabbage, soy bean, and potato the yields were less on the limed soil with than without the raw redondite. With but one or two exceptions the yields were raised somewhat by its use on the unlimed land."

Liming exerted a marked influence in increasing the efficiency of roasted

redondite, especially in case of summer squash, crimson clover, Japanese millet, Adzuki beans, and several other plants.

In case of crimson clover and Adzuki beans the raw redondite seemed to be more beneficial than the roasted. The roasted redondite was of little value in case of beets and cabbage on limed land. "Double superphosphate particularly, and in some cases dissolved boneblack and acid phosphate, proved relatively inefficient upon the unlimed land, and a few instances of the same kind were observable even where the land had been limed, particularly in the case of those plants which are liable to injury upon soil which strongly and intensely reddens blue litmus paper and which is at the same time practically devoid of carbonate of lime.

"Liming, instead of proving injurious in connection with the soluble phosphates, as is so often alleged, proved decidedly helpful in the majority of cases, and even in many instances with plants which are not particularly in need of liming. The results seem to indicate that in a soil deficient in or devoid of carbonate of lime and well supplied with the oxids of iron and aluminum, liming may extend the period of efficiency of the soluble phosphates possibly by combining with much of the phosphoric acid at once, and thus holding it in more assimilable combinations than if it were possible for it all to unite immediately with the iron and aluminum oxids. . . .

"Double superphosphate seemed to be the least adapted to acid soil of any of the soluble phosphates, namely, the dissolved bone, dissolved boneblack, and acid phosphate.

"Finely ground unacidulated steamed bone failed to fully meet the needs of some of the crops in the earlier years, but this condition soon ceased and it has given excellent results for several years, and has shown a much greater efficiency than the floats, even though a much larger quantity of phosphoric acid had already been applied in the latter than in the bone.

"Basic slag meal has proved throughout to be a highly efficient phosphatic manure. Its relative efficiency has been particularly high where those plants have been grown which are helped by liming. This is doubtless due in part to the fact that it contains far more lime than bone meal or floats. The use of fine-ground bone, basic slag meal, and floats has tended continually to make the unlimed land more favorable to clover."

In general there was little or no evidence that the nitrogen of the bone and dissolved bone was of particular advantage in increasing the yields obtained with these materials.

It is pointed out that the results in general show that care should be taken to distinguish between available and soluble phosphoric acid in the selection of fertilizers. It is also thought that the results show that the Rhode Island gardener and general farmer will do well to exercise caution in the use of floats, confining this use to especially favorable conditions, such as moist soils rich in decaying vegetable matter, and in case of such crops as certain legumes, Indian corn, millet, and possibly wheat and oats, which seem better adapted to utilizing the material to advantage than certain vegetables.

Comparative fertilizer tests of Thomas slag and agricultural phosphate, CLAUSEN (*Fühling's Ztg., 55 (1906), No. 19, pp. 640–670, figs. 9; Mitt. Deut. Landw. Gesell., 21 (1906), No. 47, pp. 448, 449; Deut. Landw. Presse, 33 (1906), Nos. 92, pp. 727, 728; 100, pp. 784, 785*).—Comparative pot tests during 1903 to 1905 with rye grass, oats, and celery on different kinds of moor soil are reported, the two phosphates being used alone and in combination with kainit, ammonium sulphate, and nitrate of soda, and also compared with superphosphate and bone meal.

The efficiency of the phosphates apparently depends to a large extent upon their action in association with other fertilizing materials, particularly those containing nitrogen. Apparently both Thomas slag and agricultural phosphate (fine-ground mineral phosphate) may cause a considerable loss of nitrogen during dry hot weather when applied in connection with nitrogenous fertilizers, especially ammonium sulphate, but the loss is greater in case of Thomas slag than in case of the agricultural phosphate. For this reason the net result with Thomas slag in such cases was not greatly superior to that obtained with agricultural phosphate, although a given amount of phosphoric acid in form of the slag is as a rule much more effective than the same amount in form of agricultural phosphate. The use of potash salts appeared to reduce the loss of nitrogen resulting from the action of the phosphates. The loss of nitrogen was greatest when the nitrogenous materials were applied as top-dressing.

In a later article the author refers to the work of Prianishnikov on the influence of ammonium sulphate on the solubility of phosphates as furnishing a possible explanation of the high availability of agricultural phosphate reported by certain investigators, especially Bachmann (E. S. R., 17, p. 17). He also emphasizes his previous conclusion that in certain cases Thomas slag exerts a decided influence in rendering nitrogen of the soil less available.

Comparative tests of Thomas slag and agricultural phosphate as fertilizers, BACHMANN (*Deut. Landw. Presse, 33 (1906), No. 89, p. 707*).—The author criticises some of the conclusions of Clausen in the article above referred to.

Comparative fertilizer tests of Thomas slag and agricultural phosphate, BÖTTCHER and BACHMANN (*Deut. Landw. Presse, 33 (1906), No. 98, pp. 768, 769*).—This is a further discussion of this subject based upon the experiments referred to in the articles noted above.

Phosphate of lime in Algeria (*Abs. in Jour. Soc. Chem. Indus., 25 (1906), No. 19, p. 942*).—The large and easily accessible deposits in the Province of Constantine, namely, those of Tébessa, Sétif, Guelma, and Aïn-Beïda, are discussed. Two classes of phosphate are now handled, (1) that containing 63 to 70 per cent of calcium phosphate, and (2) that containing 58 to 63 per cent. The cost at the quay at Bona is at present from \$2.64 to \$2.88, the price being higher than it should be on account of unsatisfactory transportation facilities.

Crude ammonia, M. DE MOLINARI and O. LIGOT (*Bul. Agr. [Brussels], 22 (1906), No. 5, pp. 571–577, figs. 2*).—Pot tests with oats of this material (concentrated gas house liquor) in comparison with nitrate of soda are reported. The growth was normal with both materials, but the nitrate was the more effective fertilizer. The crude ammonia used in these experiments contained 2.28 per cent of ammoniacal nitrogen, 1.96 per cent of organic nitrogen soluble in water, and 1.78 per cent of organic nitrogen insoluble in water. Comparative tests of the complete material with that containing only the organic nitrogen soluble in water or that insoluble in water showed that the organic nitrogen soluble in water was less effective than the complete material and that the organic nitrogen insoluble in water had no effect whatever.

The cause of the lower efficiency of ammoniacal nitrogen in comparison with nitric nitrogen (*Deut. Landw. Presse, 33 (1906), No. 78, p. 624*).—A brief review is here given of a report by Wagner on this subject in another journal, summarizing the results of 4 years' field and pot experiments.

The average of a large number of such experiments shows that if the efficiency of nitrogen in nitrate of soda on grains, beets, and potatoes, be taken as 100, the comparative efficiency of ammoniacal nitrogen is for barley 72, for oats 91, for winter wheat 98, for winter rye 76, for potatoes 88, for fodder beets 53, and for sugar beets 73. Against the more lasting effect of the ammoni-

acal nitrogen must be set the loss of nitrogen by volatilization of ammonia or ammonium compounds.

Laboratory and pot experiments show that when ammonium salts are applied to soils containing considerable amounts of calcium carbonate there is a considerable loss of nitrogen in the form of ammonium carbonate, especially if the ammonium salts are applied on the surface of a moist soil and allowed to lie some time before being cultivated in. These facts explain why ammonium salts give better results as a rule upon soils poor in lime than on those containing an abundance of this material, and why they are more efficient when thoroughly mixed with the soil than when applied as a top-dressing. It is not believed that the conversion of a part of the nitrogen of ammonium salts into less readily available forms by the action of soil bacteria plays any appreciable part in reducing the efficiency of this material as a fertilizer.

Field experiments on the fertilizing action of sulphate of ammonia as compared with nitrate of soda, Kretschmer et al. (*Arb. Deut. Landw. Gesell., 1906, No. 121, pp. XXIII+234, map 1; abs. in Mitt. Deut. Landw. Gesell., 21 (1906), No. 42, pp. 103–105*).—Cooperative experiments by the Wagner method at the experiment stations of Bonn, Bernberg, Halle, and Köslin in continuation of those by Wagner already noted (E. S. R., 15, p. 234) are reported.

The results, as in other experiments, vary with the character of the soil, weather, and crop, although in general nitrate of soda gave better results than ammonium sulphate, thus confirming Wagner's conclusions. In many cases, however, the ammonium sulphate was more effective than nitrate of soda. The nitrate is apparently better suited to acid soils than the sulphate. On the other hand, ammonium sulphate is more efficient than the nitrate on leachy soils in wet seasons.

The results show quite clearly that ammonium sulphate should not be used as a top-dressing on soils rich in lime. A map is given which shows the locations of sources of supply of fertilizing materials of various kinds.

Is nitrogen lost from the soil in fertilizing with nitrate of soda? J. Stoklasa (*Centbl. Bakt.* [etc.], *2. Abt., 17 (1906), No. 1–2, pp. 27–33; abs. in Chem. Ztg., 30 (1906), No. 90, Repert. No. 43, p. 386; Chem. Centbl., 1906, II, No. 25, p. 1778*).—Recent investigations regarding denitrification are briefly reviewed and culture experiments in which 50 gm. samples of unmanured soil, of soil fertilized with barnyard manure, and of soil fertilized with nitrate of soda, were mixed with 500 cc. of Giltay solution, and the changes which the nitrogen underwent were observed, are reported.

The results confirm in general those of previous investigations by the author and lead to the conclusion that in the reduction of nitric acid to elementary nitrogen, nitrous acid is always an intermediary product. The reduction of the nitric acid to nitrous acid is brought about by the action of nascent hydrogen, which is set free along with carbon dioxid by the cleavage action of enzyms on carbohydrates or organic acids.

The Bavarian beet soils used in these investigations were so deficient in a readily assimilable carbon supply for the respiration processes of the denitrification organisms that nitric acid was not reduced to elementary nitrogen in these soils to a sufficient extent to be detected by ordinary analytical processes. With free access of air such as accompanies ordinary thorough cultivation of soils or in soils of high air capacity loss of elementary nitrogen through denitrification does not occur, although nitrites are always formed from nitrates.

Can calcareous fertilizers be held responsible for a deficiency of nitrogen in soils? Clausen (*Illus. Landw. Ztg., 26 (1906), No. 78, pp. 674, 675, figs. 3*).—Pot experiments with clover and oats on sandy soil are reported, which

indicate that applications of lime resulted in case of such soils in a marked "nitrogen hunger," especially during dry hot weather and with nonleguminous crops. Under such conditions calcareous manures should always be accompanied by liberal applications of nitrogenous manures.

Nitrate of soda, A. PLAGEMANN (*Die Düngstoff-Industrieen der Welt: Der Chilesalpeter. Berlin: Der Saaten-, Dünger- und Futtermarkt, [1906], pp. 80, pls. 2, figs. 20*).—This is one volume of a large treatise on the fertilizer industry of the world and is a very full account of the character and exploitation of the Chilean nitrate deposits.

Lime niter for potatoes, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 12 (1906), No. 42, pp. 485, 486*).—Comparisons of nitrate and nitrite of lime (the Notodden product) and nitrate of soda in field experiments at Parc des Princes in 1906 are reported, which show that for this crop there was practically no difference in the efficiency of the different fertilizers.

Dry fertilizer from by-products or residues from sugar works, E. LALLEMANT (*French Patent No. 365,448, Apr. 20, 1906; abs. in Jour. Soc. Chem. Indus., 25 (1906), No. 20, p. 997*).—In the method proposed the damp materials are made into briquettes, which are air-dried, or dried at a moderate temperature in a kiln, or the material is mixed with quicklime or roasted gypsum in lumps.

On the use of sulphocyanids as fertilizers, R. PEROTTI (*Staz. Sper. Agr. Ital., 39 (1906), No. 3, pp. 193–212, fig. 1; abs. in Chem. Centbl., 1906, II, No. 16, p. 1282*).—The material used in the pot experiments here reported is manufactured in Belgium from gas liquor. The sample examined by the author contained 5.06 per cent of total nitrogen, 1.66 per cent of ammoniacal nitrogen, 0.8 per cent of phosphoric acid, 2.28 per cent of potash, 1.78 per cent of lime, 23.88 per cent of sulphur, and 4.5 per cent of ammonium sulphocyanid.

The results obtained with a number of crops, including wheat, oats, corn, flax, etc., show that unless the sulphocyanid is present in the soil in highly concentrated solution there is little danger of injury to vegetation. The material undergoes a rapid and complete transformation in the soil without loss of nitrogen. Considered as a source of nitrogen it was in these experiments somewhat more economical than ammonium sulphate. It is proposed to test the results of the pot experiments by experiments in the field.

AGRICULTURAL BOTANY.

Botanical studies applied to agricultural plants, G. FRON (*Traité Élémentaire de Manipulations de Botanique Appliqué à l'Étude de Plantes Agricoles. Paris: C. Amat, 1907, pp. VII+228, figs. 137*).—This work treats mainly of the gross and minute anatomy of agricultural plants. It is not intended as a substitute for some of the more comprehensive botanical treatises, but is offered as a guide to the study of a number of types illustrative of the large number of agriculturally important plants.

After a rapid review on the uses of the microscope, its technique, methods of preparation, etc., studies are given of a number of plant products. The author then takes up the following plants which are representative of types: Onion, asparagus, wheat, grape, bean, pea, sugar beet, hemp, flax, mustard, cabbage, potato, tobacco, gourd, dodder, broom rape, Melampyrum, Jerusalem artichoke, carrot, parsnip, etc. Following these, studies are given on the structure of various timbers used in construction, including oak, walnut, beech, alder, pine, spruce, etc.

A brief bibliography of some of the more important literature is given at the end of each chapter.

Hybridization of wild plants, D. T. MacDougal (*Bot. Gaz., 43 (1907), No. 1, pp. 45–58, figs. 4*).—The author discusses the hybrid origin of a number of so-called natural hybrids that exist wild, and in some instances he thinks the evidence favors such hybridity. The various conditions under which hybrids can be formed are described, and a list is given of natural hybrids that have been reported as occurring in the indigenous flora of North America.

The action of ozone on germination, H. Micheels and P. De Heen (*Acad. Roy. Belg., Bul. Cl. Sci., 1906, No. 6, pp. 364–367, pls. 2*).—The general interest in the physiological action of ozone, due not only to the radio-activity and other properties of the gas, but also on account of its frequent production in the air, led the authors to study its effect on the germination of wheat. A specially devised apparatus was constructed to cut off the effects of static electricity, and after a preliminary soaking for 24 hours in tap water the seeds were placed to germinate, checks being maintained without ozone. In every instance the ozone had an injurious effect as shown not only in a decreased number of germinations, but also in a marked diminution in the weight and size of the seedlings.

The stimulating action of manganese on germination, H. Micheels and P. De Heen (*Acad. Roy. Belg., Bul. Cl. Sci., 1906, No. 5, pp. 288, 289*).—Various investigators having shown the stimulating effect of manganese sulphate on rice (E. S. R., 16, pp. 42, 43) and on oats (E. S. R., 17, p. 954), the authors carried on experiments to determine the effect of a colloidal solution of manganese on the germination of wheat, comparisons being made with a colloidal solution of tin.

In other experiments of the authors[a] a colloidal solution of tin was found to stimulate the germination of peas and wheat. Not only was a greater percentage of germination obtained, but there was a decided increase in the weight of the seedlings and the length of the root development. In the experiments with the colloidal solution of manganese even more marked stimulating effects were observed. These colloidal solutions are believed to act upon the reserve material of the seed, having a sort of diastatic rôle.

The effect of different solar radiations on the nitrogen content of wheat, J. Dumont (*Compt. Rend. Acad. Sci. [Paris], 143 (1906), No. 26, pp. 1179–1181*)—In continuation of previous experiments (E. S. R., 17, p. 1145), the author has studied the effect of different colored screens on the nitrogenous material in wheat.

In the experiments reported equal areas of wheat in full flower were covered with frames containing different colored glass, and the effect of the different radiations on the total yield of straw, chaff, and grain, as well as the difference in the nitrogen content, was noted. Comparisons were made with equal areas of wheat grown in the open air and under frames containing clear glass.

The total yields per square meter of straw, chaff, and grain for the different lots were as follows: Open air 666 gm., under clear glass 670 gm., black, or where all the visible spectra were cut off, 846 gm., green 856 gm., red 912 gm., and blue 952 gm.

The nitrogen, albuminoids, and gluten were determined. There was found to be a progressive increase in the amount of nitrogen through the clear, red, and green glass to the blue, after which there was a falling off toward the other end of the spectrum. An examination of the figures presented shows that there is a decided influence on the nitrogen content of the plant on the part of the more refrangible rays of the spectrum. By reducing the amount of nitrogenous mate-

[a] Acad. Roy. Belg., Bul. Cl. Sci., 1905, No. 7, pp. 310–318.

rial to percentages there is shown to be at least 30 per cent increase in the total nitrogen in the plants grown under the blue glass.

The author claims that these experiments, as well as those previously reported, show that the radiations at the right of the spectrum assist very materially in the translocation of nitrogenous materials, particularly the gluten in the wheat grain during the time of its ripening. They also favor the formation of albuminoids, and it is claimed that their physiological action is no less important than that of those at the other extremity.

Toxic limits and stimulation effects of some salts and poisons on wheat, G. H. JENSEN (*Bot. Gaz., 43 (1907), No. 1, pp. 11–44, figs. 34*).—The present work was undertaken for the purpose of ascertaining the toxic limit for wheat plants in both solutions and soil cultures. The wheat seeds were germinated in sphagnum and in quartz and transplanted to water cultures or to paraffined wire baskets containing ground quartz, after which they were supplied with culture solutions containing different strengths of copper sulphate, lead nitrate, silver nitrate, zinc sulphate, iron nitrate, iron chlorid, nickel nitrate, phenol, and alcohol.

The responses to the toxic salts are said to be of two kinds, acceleration and a retardation of growth which progresses as the concentration increases until the death point is reached.

The author compared the effect of the different substances tested on the total transpiration from each pot or culture, the average length of the sprout, the green weight and the dry weight of the plants.

The different series of investigations are reported at length, and in conclusion the author points out that while considerable work has been done on toxicity, none has shown the definite effects of a poison in pure soil. Such experiments as have been made with garden loam are unreliable because of the multiplicity of inorganic and organic substances with which the introduced poison may react. The author's investigations have shown that the introduction of pure quartz flour into a toxic solution, in such proportion as to form an ordinary moist soil, reduces the toxicity of the solution in a marked degree. Whether this is due to absorption, to a reduced freedom of movement of the soil particles, or to some chemical changes is yet to be determined.

Of the poisons tested all gave stimulating results in quartz, and all but zinc and copper sulphates in the solution cultures. It is thought probable that in proper concentration these 2 might also be found stimulating.

The more dilute the fatal dose in solution, the more the toxic effect is reduced by the introduction of quartz. Hence the range of concentrations, both fatal and accelerating, is much greater in solution than in soil cultures. The report concludes with a bibliography of literature relating to the subject.

Some investigations on the injury to plants by sewage, P. EHRENBERG (*Ztschr. Pflanzenkrank., 16 (1906), No. 4, pp. 193–202*).—A study was made to determine the effect on plant life of sewage from a sewage-disposal farm.

It was found that the paper pulp, fat, and various salts carried by the sewage had an injurious effect on all crops experimented with, the paper pulp and fat being mechanically injurious, while the salts were chemically noxious. In the case of cereals the plats receiving the sewage were later in ripening and yielded less grain in proportion to straw than where no sewage was applied. In a number of instances there seemed to be a greater tendency to plant diseases on the treated plats.

The influence of concentration of nutrient solutions on the development of

some algæ, A. ARTARI (*Jahrb. Wiss. Bot.* [*Pringsheim*], *43* (*1906*), *No. 2, pp. 177–214; abs. in Bot. Centbl., 102* (*1906*), *No. 23, p. 595*).—Experiments were carried on with a number of species of green algæ in which the influence of different concentrations of nutrients was studied.

It was found that ammonium nitrate, which served as a source of nitrogen for the algæ, was without appreciable effect in solutions of 0.05 to 0.5 per cent. Higher concentrations retarded growth, until at 5 per cent all growth ceased. From the action of various salt solutions they were believed to have other effects than those due to their osmotic activity. The nutritive value of the different solutions of nitrogen varied somewhat, depending upon whether or not glucose was present in the solution. The stimulating effect of the glucose was apparent in strengths as low as 0.005 per cent, and it increased to an optimum for the different species of algæ between 0.5 and 2 per cent. The limit of concentration of the disaccharids was found to be almost double that of the monosaccharids.

The retarding effect of sodium chlorid was very evident even in the weakest solution, and with an increase in strength of the solution the injurious effect was quickly shown. Magnesium sulphate had only a slight retarding influence.

Tannin cells of persimmons, B. J. HOWARD (*Bul. Torrey Bot. Club, 33* (*1906*), *No. 11, pp 567–576, figs. 8*).—In a previous publication an account is given of the changes which take place in the tannin cells of persimmons during ripening (E. S. R., 17, p. 613), and in the present paper the subject is discussed at considerable length.

The author has found that the tannin cells in the different species of persimmon examined differ materially in appearance and that the changes taking place during the ripening process may be divided into three stages.

In the green stage the tannin does not appear to be strongly localized, for though it appears most abundantly in the loose parenchyma tissue where the tannin cells are located, yet it is not limited to these cells nor even to the region where the cells are most abundant.

In the second stage of ripening radical changes occur in the physical and possibly in the chemical constitution of the tannin. The tannin at this stage is being or has been collected into the tannin cells, and the contents of these cells become highly refractive.

In the last stage the tannin masses have become highly refractive and the addition of water causes little, if any, swelling. The contents of the cells are friable, and pressure upon the cover slip results in the fracturing of the tannin masses into irregular fragments.

While the disappearance of the astringency and the development of mushiness of the fruit are commonly associated, the author found that these features do not run parallel, as it frequently occurs that mushiness develops before the astringency is gone, while in other cases just the reverse is true. This is the case particularly in specimens of Japanese persimmons cured by the saki process.

A study of beans yielding hydrocyanic acid, L. GUIGNARD (*Rev. Vit., 26* (*1906*), *Nos. 655, pp. 5–9, pl. 1; 656, pp. 33–37; 658, pp. 89–95; 667, pp. 341–350, figs. 9; 674, pp. 543–547; 675, pp. 573–576; 677, pp. 626–631; 678, pp. 663–667; 679, pp. 689–694; 680, pp. 715–721*).—An historical, botanical, and chemical study is given of *Phaseolus lunatus*, a number of the varieties of which have poisonous properties due to hydrocyanic acid. A number of forms that have been described as distinct species are by the author believed to be varieties or cultural forms of *P. lunatus*. Those principally studied were the white and colored Java beans, Burma or white Indian beans, Sieva beans, Cape beans, which are extensively cultivated in Madagascar, and Lima beans. These dif-

ferent varieties are widely cultivated and extensively used as food, although a number of fatalities have been attributed to their use. Descriptions of the different varieties and detailed reports of the chemical studies are given.

Practically all varieties of *P. lunatus*, whether wild or cultivated, were found to contain the principle which when acted upon by an enzym yields hydrocyanic acid. The proportion of hydrocyanic acid varied from almost inappreciable amounts in some of the more improved forms, like the Lima bean, to as much as 60 to 320 mg. per 100 gm. dry weight in certain varieties of Java beans. It was found impossible by cooking to remove all the cyanogenetic compound in Java beans. Prolonged boiling extracts the greater part, but it is merely withdrawn and not destroyed, and if the water is absorbed it presents the same danger as the beans themselves, since either in the alimentary tract or in the blood there are sufficient ferments to act upon the dissolved glucosid, resulting in the liberation of hydrocyanic acid.

Incidental to the investigation the author discovered a new method for detecting the presence of hydrocyanic acid in plants. It is based upon the action of hydrocyanic acid in changing to a red color a mixture of picric acid and an alkali through the formation of isopurpuric acid. Strips of blotting paper are soaked in an aqueous solution of picric acid, dried, impregnated with a solution of carbonate of soda, and again dried. A strip of this paper suspended in a test tube containing 1 or 2 cc. of liquid containing hydrocyanic acid will after a time take on an orange red color, afterwards changing to red, the rapidity of coloration depending upon the temperature and amount of acid in the solution. A solution containing 0.005 mg. of hydrocyanic acid will change the paper to orange red in 12 hours, and 0.002 mg. will be indicated within 24 hours.

A second Ohio weed manual, A. D. SELBY (*Ohio Sta. Bul. 175, pp. 291–384, figs. 73*).—This is a revised and enlarged edition of Bulletin 83 of the station (E. S. R., 9, p. 1054).

After an introductory statement regarding the nature of weeds, methods of introduction and spread, vitality of weed seeds, etc., the author gives an illustrated descriptive list of 385 species of weeds that have been observed to occur in Ohio. The more obvious characters of each weed are described and illustrations presented of those which are most injurious or which have been but recently introduced. Wherever possible the seed characters of the plants are presented. The descriptive list is arranged according to the plant families, the common and scientific names being given.

The author calls attention to the occurrence of foreign seeds found in various samples of commercial seed, listing the species of weed seeds that have been observed in red clover, alfalfa, alsike clover, timothy, and oats.

FIELD CROPS.

A successful hog and seed-corn farm, W. J. SPILLMAN (*U. S. Dept. Agr., Farmers' Bul. 272, pp. 16, figs. 5*).—This bulletin contains a description of the system of management on a successful hog and seed-corn farm in Illinois. The main points discussed are the general management of the farm, the construction of shelters for hogs, the culture of soy beans and corn, the feeding value of corn, clover, and soy beans, the rotations followed on the farm, and the financial results secured.

Forage crop practices in western Oregon and western Washington, B. HUNTER (*U. S. Dept. Agr., Farmers' Bul. 271, pp. 39, figs. 4*).—This bulletin is identical with Bur. Plant Indus. Bul. 94 (E. S. R., 18, p. 229).

Annual report of the Burdwan Agricultural Experiment Station for

1905–6, F. Smith (*Ann. Rpt. Burdwan Expt. Sta. [India], 1905–6, pp. 29+XV*).—A brief description of the station and its work for the year is given.

The results with rice indicate that the use of cow manure and nitrate of soda, as well as green manuring with jute and dhaincha, is profitable. Transplanting seedlings to about 12 in. apart proved most satisfactory. The varieties of rice considered the best were Badshahbhog and Dadkhani from Bengal and Kamod from Bombay. Varieties of jute giving the best results are enumerated. Thinning out plants to 4 in. apart and sowing the third week of April in the Burdwan district is recommended. The use of cow manure considerably increased the yield of fiber.

Annual report of the Cuttack Agricultural Experiment Station for the year 1905–6, F. Smith (*Ann. Rpt. Cuttack Expt. Sta. [India], 1905–6, pp. 12*).—A brief description of the station is given and the results of experimental work for the season are reported.

Of the different varieties of aman paddy tested Benaphuli ranked first in productiveness, with a yield of 2,000 lbs. of grain and 3,700 lbs. of straw per acre. Transplanting one seedling per hole proved most successful. The use of 60 lbs. of seed sown broadcast gave as good returns as the use of 50, 70, or 80 lbs. Irrigation gave a favorable increase in yield, and transplanting proved better than broadcasting. Only two varieties of aus paddy were compared, and of these the variety obtained from the Central Provinces was the more productive. A yield of 1,600 lbs. of peanuts per acre is reported and notes are given on the conservation of manure and the distribution of seeds.

Annual report of the Dumraon Agricultural Experiment Station for the year 1905–6, F. Smith (*Ann. Rpt. Dumraon Expt. Sta. [India], 1905–6, pp. 16, fig. 1*).—Brief notes on the station are given and the results of experiments on sugar cane, paddy, wheat, mustard, and rape are reported.

In fertilizer experiments with sugar cane the use of cow manure and castor cake gave the best yields. Of the varieties tried Khari sugar cane proved hardiest. Of the three systems of sugar cane culture, the local, the Bihar Planters' system, and the Poona system, the last mentioned gave the best results. This system consists in laying out the land into beds 10 ft. square, each bed being divided into four trenches and ridges. A water channel for irrigating purposes extends around the bed and connects with each trench.

In fertilizer experiments with aman paddy the best yields were secured from the use of 2,560 lbs. of cow manure per acre. The results from fertilizer experiments with wheat show that the use of poudrette produced the highest yield of grain, but that the increase in yield was insufficient to pay for the fertilizer. Lying fallow in the bhadoi season gave the best economical returns. The red deshi variety of wheat proved to be the best general-purpose sort. Indian mustard of Raipur and of Jabbalpur are two varieties recommended for general planting.

The state farms, A. Despeisses (*Jour. Dept. Agr. West. Aust., 14 (1906), No. 5, pp. 333–342, pl. 1*).—Brief reports are given on the work at the three state farms at Chapman, Narrogin, and Hamel. At Chapman, in a variety test of wheat, Toby Luck ranked first, with a yield of 22 bu. per acre. This variety produced strong straw and plump grain. Brief notes are given on the different field crops grown at these stations.

Experimental stations [Report on field crops], E. Clifton (*New Zeal. Dept. Agr. Ann. Rpt., 14 (1906), pp. 186–245, pls. 23*).—Brief reports are given on work conducted at the Waerenga, Ruakura, Bickerstaffe, Selwyn, Motuihi, Weraroa, and Momohaki stations.

Experiments in top-dressing grass land at Waerenga showed that a single application of 10 cwt. per acre produced the heaviest crop of grass, with the

largest proportion of leguminous plants. In growing potatoes a fertilizer application consisting of 6 cwt. of bone dust, 2 cwt. of kainit, 28 lbs. of sulphate of iron, and 4 cwt. of basic slag per acre was used. The results indicated that the kainit and sulphate of iron might have been omitted, and that the quantities used of bone dust, or blood and bone, and of basic slag probably formed the best application for this crop on the clay land in question. Seed potatoes imported from California produced the healthiest plants. Spraying with permanganate of potash solution did not keep the plants healthy, while those sprayed with Bordeaux mixture were satisfactory.

At the Ruakura station ½ ton of basic slag per acre was not as effective on grass as 2 cwt. of dissolved bone. Fertilizer and culture tests with various field crops are reported without comment.

Algerian oats was in general the most rust-resistant variety of oats grown at Momohaki, and Abundance produced good crops. Marshall White Chaff wheat yielded 53 bu. per acre and Cape Barley 73.8 bu. Root crops responded quicker to superphosphate than to other forms of phosphoric acid. The use of 4 cwt. of superphosphate per acre produced a ton of increase in yield at a lower cost than any other application. Sutton Yellow Globe Mangold ranked first in production, with a yield of over 46 tons of roots per acre.

At the Weraroa station 4 imported varieties of oats, Abundance, Storm King, Scotch Potato, and Goldfinder, yielded 31.2, 36.2, 42.5, and 47.5 bu. per acre, respectively.

[Report on pasture and old land hay plats], D. A. GILCHRIST (*County Northumb., Ed. Com., Bul. 8, pp. 45–81, dgms. 4*).—This bulletin contains a report on 3 different series of experiments in progress for a number of years.

The general results of all the trials show that for improving extensive areas of poor boulder clay pasture in Northumberland a dressing of 10 cwt. of basic slag per acre may be used with profit. Superphosphate and lime and phosphatic manures other than slag are useful for this purpose, but not so profitable. It is believed that the initial treatment may be advantageously followed by dressings of 5 cwt. of slag per acre about every 3 years, and the judicious feeding of cake to the grazing stock. For poor, old pasture on sandy soils slag, together with a potash manure, is recommended. The feeding of cake and the use of slag on poor pasture is considered as greatly aiding in the development of sweet herbage on the lowlands. Liming was found expensive and profitable only under special circumstances.

At Cockle Park applications of slag and barnyard manure were very effective in developing fine grass and clover on thin hay and pasture land. Where barnyard manure was applied potash and nitrogenous fertilizers were not profitable. In one instance in these tests the use of a complete commercial fertilizer in combination with barnyard manure gave very poor results.

The utilization of water by rye, barley, wheat, and potatoes, C. SEELHORST (*Jour. Landw., 54 (1906), No. 4, pp. 316–342*).—The results reported show that on clay soil wheat required 333 gm. of water for the production of 1 gm. of dry matter, rye 375 gm., and potatoes 66.3 gm. The amount of water used by rye during April and May was larger than the amount used by wheat, but after this period until harvest wheat used much more water than rye. From June 1 to June 21 the quantity of water used by rye increased slightly, while that used by wheat increased considerably. Both crops reached their maximum on June 21. The water utilization of the potato increased quite rapidly from the end of May to July 10, and from this date until August 1 it remained about the same. Beginning August 1, the quantity of water used decreased quite rapidly at first and then gradually until harvest.

On sandy soil the quantity of water used to produce 1 gm. of dry substance in the grains ranged from 446.5 gm. to 501.2 gm., while for potatoes the range was from 58.4 to 61.4 gm. It is pointed out that the quantity of water transpired by these plants stood in direct relation to the yield, and as the production of a crop is largely dependent upon the supply of available nitrogen in the soil, it is concluded that the requirements for nitrogenous fertilizers and water bear a relation to one another.

The effect of injury to the spike and the stem of grains, C. Eberhart and H. Metzner (*Fühling's Landw. Ztg., 55 (1906), No. 21, pp. 709–725*).—A previous paper on this subject is reviewed and the results of later work are reported.

It was found in work with barley that injury to the spike caused a decrease of 14 per cent in the yield of grain, the breaking of the stem in the first or upper internode a reduction of 28 per cent, and a combination of the two injuries a loss in yield of 38.5 per cent. The quality of the grain was also affected, an injury to the spike, such as bending it out of shape, reducing the quality much more than the breaking of the upper internode, although the combined action of these two injuries reduced the quality to a greater extent than either one of them alone.

The stems of spring rye were injured June 12 and 20 and July 17. The reduction in yield caused by these injuries varied from 21 to 60 per cent. It was also noticed in these tests that the breaking of the first or upper internode reduced the yield much more than a similar injury to the second internode.

Observations were also made on the effect of hail on crops of barley, oats, rye, and wheat, and the reductions in yield due to injury to the spike and different parts of the stem were determined and are reported in a table.

Alfalfa seed testing, O. M. Ball (*Texas Sta. Bul. 81, pp. 15, pl. 1, figs. 3*).—Directions are given for testing the purity of alfalfa seed and the weed seeds frequently found in it, together with seeds sometimes used as its adulterants, such as bur clover and sweet clover, are described.

In 1905 the station tested 32 samples of alfalfa seed obtained from the wholesale seed houses of the State. In these samples 30 different weed seeds were found. The percentage of sand, trash, and broken seed varied from 0 to 29 per cent. Testing the vitality of the seed is also described. The results secured with the 32 samples showed their vitality or germinating power to vary from 49.5 to 96.5 per cent, the greater number having a vitality of over 80 per cent. The actual values of the seed samples in percentages varied from 39.6 to 96. The results in detail are given in a table.

First report on the fertilizer experiments with brewing barley in 1906, O. Reitmair et al. (*Ztschr. Landw. Versuchsw. Österr., 9 (1906), No. 2, pp. 975–1002*).—Cooperative fertilizer experiments are reported in which barley was fertilized with superphosphate at the rate of 200 kg. per hectare for the purpose of determining how the use of phosphate alone might influence the protein content.

The average protein content of the barley on the unmanured plats was 9.38 per cent, and on the manured plats 9.44 per cent, calculating the water content of the barley at 14 per cent. Reductions in the protein content due to the use of superphosphate were in most cases very unimportant. The protein content of the barley grown on the plats was in most instances lower than that of the seed used, the average for the crop being 9.53 per cent, while that of the seed was 10.14 per cent. This is attributed to the favorable weather conditions during the season of 1906, and it is believed that the weather conditions constitute the greatest factor in determining the protein content of barley. No relation of the protein content in the crop to the protein content of the seed used was shown by the results secured.

In grouping the experiments according to the nitrogen content of the soil it was found that the relative frequency with which phosphoric acid produced an increase in yield declined with the nitrogen content of the soil. It is not believed, however, that the application of nitrogen on these soils is necessary to obtain the complete effectiveness of phosphatic fertilizers. The results further showed that a high nitrogen content of the soil is without influence on the protein content of the barley produced.

Corn selection, F. W. CARD (*Rhode Island Sta. Bul. 116, pp. 19–35, figs. 9*).—The purpose of the experiments here reported, which have been previously described (E. S. R., 17, p. 858), has been to determine the possibility of increasing the number of ears per plant by selection. The work was begun in 1898, but detailed records have been kept only since 1901. The variety under test was Potter Excelsior sweet corn. In 1901, 35 per cent of the plants bore more than one ear and in 1905, 90 per cent bore more than one ear, the highest number of ears from a single plant being 13. Selecting seed from the lower ear on the stalk was not as satisfactory as selection from the upper ear.

The selection, preservation, and preparation of seed corn, A. T. WIANCKO and G. I. CHRISTIE (*Indiana Sta. Circ. 2, pp. 14, figs. 10*).—The importance of this work is pointed out and detailed directions for carrying it into effect are given. In several of the poorer and better fields examined by the station the stand ranged from 65.6 to 89.6 per cent, and the number of ear-producing stalks from 49.2 to 84.8 per cent. In studying the effect of the irregularity of kernels on the regularity of drop in planters it was found that where middle or deep kernels only were used the planter dropped 3 kernels 92 times in 100 drops. Where shallow kernels were used, 3 kernels were dropped 95 times in 100 drops, as compared with 66 times where the whole ear was used and 75 times where deep and shallow kernels were mixed.

Hints on preparing for and holding local corn shows, A. T. WIANCKO and M. L. FISHER (*Indiana Sta. Circ. 1, pp. 13, figs. 2*).—Directions are given for the selection and preparation of exhibits of corn for show purposes. Notes are presented on the time and place of holding corn shows, the arrangement and disposition of the exhibits, the judging of the corn, and the premiums offered.

Breeding an early, rapid fruiting, and productive cotton, R. L. BENNETT (*Texas Sta. Bul. 79, pp. 9, figs. 5*).—This work has been previously noted (E. S. R., 16, p. 867). This bulletin contains a brief account of the breeding work during the 2 years these observations have been in progress.

The investigations have shown that early cottons have short joints, with the first fruit limbs near the ground, and that late cottons have long joints, with the first fruit limbs a considerable distance above the ground. For early fruiting in the plants selected the first fruit limbs should not be higher than the fifth joint above the seed leaf joint and the first primary or wood limbs not above the fifth joint and not exceeding four in number. For rapid fruiting the joints on the main stem, fruit limbs, and primary limbs must be short, preferably not over 2 or 3 in. The fruit limbs should grow in succession at each joint of the main stem and primary limbs and be continuous in growth for continuous fruiting, and for productiveness the bolls should be at least 1½ in. in diameter, the percentage of lint to seed cotton not less than 33⅓, and the growth rapid and vigorous. The rate of growth is considered very important, and it is pointed out that the larger the plant of the type the greater its inherent rate of growth, its earliness, rapidity of fruiting, and yield.

The improvement of the cottons of the Bombay Presidency, F. FLETCHER (*Agr. Jour. India, 1 (1906), No. 4, pp. 351–389, maps 2*).—Cotton culture in the Bombay Presidency is described and a review of some of the experimental

work with the crop, together with an outline of the improvement work is given. The 5 different cotton growing tracts of the Presidency are noted in detail.

Varieties of Egyptian cotton have been introduced and in the case of indigenous varieties at least one extremely promising hybrid has been secured, although sufficient seed has not yet been grown for distribution. In the variety tests the Broach variety did not give a larger yield of seed cotton per acre than Kumpta, but owing to better ginning results its value was at least 20 per cent greater. The percentage of fiber of both varieties was lower in years of small rainfall. In a comparison with the Egyptian Abassi, Sea Island gave a higher yield and the crop is estimated at about 30 per cent greater in value. Tree cottons gave promising, but as yet, indefinite results.

The application of heavy and medium dressings of barnyard manure largely reduced both the quality and the quantity of the crop. The fertilizer experiments and irrigation tests indicated that the quantity of manure applied must be regulated by the quantity of water the crop receives, and that in most parts of India water is by far the more important of the two. Commercial fertilizers have not shown themselves effective, but this is considered due to a shortage of rain.

Kumpta and American cotton planted in June and July gave much better yields than when planted in August and September.

Supply and distribution of cotton, D. C. Roper (*Bur. of the Census* [*U. S.*] *Bul. 63, pp. 25*).—This bulletin constitutes a report on the supply and distribution of cotton for the year ending August 31, 1906. In addition to these statistics, the latest available data relative to the consumption of cotton and to the imports and exports of this staple and its manufactures in other important manufacturing countries are given.

The total supply was 13,055,260 running bales. Stocks held September 1, 1905, amounted to 1,934,548 bales. Cotton grown in 1905 returned as ginned after August 31, 1905, amounted to 10,248,947 bales and that grown in 1906 returned as ginned before September 1, 1906, to 407,551 bales. The shortage in ginners' returns of production for growth of 1905 as shown by distribution statistics was 336,739 bales, and the net imports for the year ending August 31, 1906, reached 127,475 bales. The distribution is summarized as follows: Exported, 6,673,041 bales; consumed, 4,909,479 bales; destroyed by fire, 25,760 bales; stocks held August 31, 1906, 1,356,980 bales.

Culture and utilization of cyperus, Bui-Quang-Chiêu (*Bul. Écon. Indo-Chine, n. ser., 9 (1906), No. 57, pp. 974–998, figs. 15*).—The culture, preparation for market, commerce, and use of this plant are discussed, and a botanical account of different species is given.

Flax culture, H. L. Bolley (*North Dakota Sta. Bul. 71, pp. 139–216, pls. 22*).—This bulletin is a treatise on methods of flax culture, soil characteristics, and methods of handling the crop in the United States, Holland, Belgium, Germany, Russia, Austria, and Hungary.

The conditions and prospects of flax culture in the United States are discussed and methods for the improvement of the flax industry in America recommended. The European explorations and investigations by the author were made for the purpose of obtaining new varieties and strains of flax adaptable to differences in soil and climate and possessing greater resisting capabilities to flax wilt and other diseases affecting flax culture. Each step in the culture of the crop, as well as in its preparation for spinning and weaving purposes in the different countries visited, is described in detail.

For the improvement of flax growing in this country the author recommends the use of home-grown seed graded to a bright, plump type and treated with a solution of 1 lb. standard 40 per cent formaldehyde in 40 gal. of water. He fur-

ther advises the practice of crop rotation, including at least two cultivated crops and two or more years in grass and pasture, avoiding the use of poorly composted barnyard manure containing flax straw and never to employ plows, harrows, and other tools used on wilt-infected land in working healthy soil.

The extension of jute cultivation in India, R. S. Finlow (*Agr. Research Inst. Pusa [India] Bul. 3, 1906, pp. 46, maps 3*).—This bulletin is a report on a tour made for the purpose of investigating the possibility of extending the cultivation of jute to areas outside of Bengal. The conditions favorable for jute cultivation are summarized as a high temperature, a deep soil of fairly fine texture, a rainfall of over 40 in. so distributed that the young plants have plenty of moisture to grow vigorously, but the bulk of the fall taking place when the crop is more mature, and a sufficient supply of clear water for retting. General directions for cultivating jute are given and the condition of the industry in different sections of India is described.

Mineral matter in the lower parts of oat stems in its relation to lodging, D. Lienau and A. Stutzer (*Landw. Vers. Stat., 65 (1906), No. 3-4, pp. 253-263*).—A review of work previously noted (E. S. R., 15, p. 769), with the results given in a concise form and systematically arranged.

Potato investigations, W. J. Green and C. W. Waid (*Ohio Sta. Bul. 174, pp. 251-289, figs. 18*).—The work here reported consisted of spraying and seed selection experiments and variety tests.

Among the 150 varieties grown in 1905, Thorburn White Peachblow, Improved Early Rose, Lily White, Uncle Sam, Lee Favorite, Sensation, Miller-Brook, Bovee, Cracker Jack, and Irish Cobbler produced the heaviest yields. Of the varieties tested the past 3 years Thorburn White Peachblow, Uncle Sam, Improved Early Rose, Summers, Early Rose, Whiton White Mammoth, Spring Valley No. 2000, Seedling No. 110, Sensation, and Sweet Home were the highest producers. Admiral Dewey, Bovee, Early Harvest, Early Ohio, Early Trumbull, and Irish Cobbler are recommended for early market varieties, and Carman No. 3, Ionia Seedling, President Roosevelt, Thorburn White Peachblow, Vt. Gold Coin, and W. W. Mammoth for late market sorts. Bovee, Early Ohio, Early Manistee, and Maxima are recommended as early varieties for home use, and President Roosevelt, Thorburn White Peachblow, Vt. Gold Coin, Vornehm, and W. W. Mammoth as late varieties for home use. A number of other varieties also gave good yields, but have not as yet been fully tested.

Of the varieties grown the past two seasons 33 per cent showed susceptibility to and 30 per cent resistance to early blight. It is stated that by selecting seed from hills showing a tendency to resist the early blight a strain may be secured which would be resistant but not immune. Late blight at the station was controlled to a considerable extent by spraying with Bordeaux mixture, the gain from spraying amounting to 36 per cent.

Rice culture in Tonkin, Bui-Quang-Chiêu (*Bul. Écon. Indo-Chine, n. ser., 9 (1906), No. 55, pp. 781-839, figs. 7*).—A monograph on rice culture in Tonkin describing the different methods practiced in growing, preparing, and marketing the crop, noting the different varieties cultivated and giving statistics with reference to production and consumption of rice in that country.

The influence of fertilizer applications on the composition of the grain of rye, S. de Grazia and S. Caldieri (*Staz. Sper. Agr. Ital., 39 (1906), No. 6-7, pp. 514-528*).—Experiments were made with nitrate of soda, sulphate of ammonia, chlorid of potash, and sulphate of potash.

The results indicate that apparently the content of ash and fat is not influenced by the use of nitrogenous or potassic fertilizers. Applications of nitrate of soda and sulphate of ammonia increased the percentage of albuminoids, the nitrate of soda being the more effective in this regard. Chlorid and sulphate of

potash exerted a smaller influence on the albuminoid content. Sugar and starch showed but little variation. The amids increased with the use of each of the four substances. Chlorid of potash was most effective in this respect, while the sulphate stood next in influence to nitrate of soda and sulphate of ammonia. Through the action of each of these substances the cellulose content was decreased, chlorid of potash causing the greatest and sulphate of potash the smallest decrease.

Solanum commersoni, L. BUSSARD (*Jour. Agr. Prat., n. ser., 12 (1906), No. 49, pp. 711–713*).—A violet strain of *Solanum commersoni* was compared with Giant Blue potato and the results showed that the *S. commersoni* variety gave a yield 64 per cent greater than the Giant Blue. In other tests here discussed the yielding capacity was also in favor of *S. commersoni*. In one experiment a plant of this strain, planted August 15, had produced 600 gm. of tubers by October 15.

Breeding seedling varieties of sugar cane by means of crossing and chemical selection, J. D. KOBUS (*Meded. Proefstat. Oost-Java, 4. ser., 1907, No. 29, pp. 137–143*).—Experiments were made with the varieties Cheribon and Chunnee, canes of high and of low sugar content of both varieties being crossed in different combinations.

The results indicated that in the heavy plants secured from the high sugar content parents, as well as those secured from the low sugar content parents, the difference in sugar content was about equal to the average difference of all plants in both groups. The seedlings highest in sugar and descending from parents with a high sugar content were heavier than those coming from the low sugar content group. It was further observed that the seedlings of a high sugar content coming from selected plants high in sugar were much more numerous than the seedlings from selected low sugar content parents. This showed that the chances of obtaining seedlings high in sugar content are three times as great in using high sugar content parents as in using low sugar content parents.

The sugar-cane experiment station, T. F. SEDGWICK (*Estac. Expt. Cana Azúcar [Peru] Bols. 1, 2, 3, 4, pp. 42, pls. 4*).—The first bulletin in this collection describes the general working plan of the station, the second points out the technical management of sugar-cane plantations in Peru, the third presents a detailed plan of the lines of work undertaken, and the fourth reports the results of observations on the seed production of sugar cane. The results secured show that seedless canes stand higher in sugar content and purity than seed-producing canes.

Saving the sweet potato crop, G. W. CARVER (*Alabama Tuskegee Sta. Bul. 10, pp. 14, figs. 6*).—Observations made on the methods of storing sweet potatoes indicate that potatoes dug and banked after a long dry period generally kept well, while those dug and banked after and during a rainy season almost without exception kept poorly. It was also observed that if potatoes were cut or broken and the milky juice turned to a dark greenish color when dried in the air they kept poorly, but if the juice dried white and the injury showed a tendency to heal over they kept well.

Directions for harvesting and storing a crop are given. To store sweet potatoes successfully it is recommended that the plants be set out as early in the spring as late frosts permit, to house or bank the crop only when thoroughly ripe, and to avoid all injury in harvesting.

Technical bulletin on the cultivation of tobacco, A. SPLENDORE (*Bol. Tec. Coltiv. Tabacchi [Scafati], 5 (1906), No. 4–5, pp. 172, pls. 59*).—Several types of tobacco and a long list of varieties are described. Abstracts of experiments with tobacco by a number of investigators are given, and the results of investigations at the Royal Experiment Station at Scafati are reported.

A cross between the varieties Salento and Italia ranked lower in burning quality than Kentucky. A reduced development of the leaf was associated with a diminished burning capacity. The burning quality also diminished from the top toward the base of the leaf, and the use of potash as a fertilizer seemed to increase the combustibility of the middle portion of the leaf. The weight per thousand plants and per hectare was greater when 10 leaves were allowed to develop per plant than when from 11 to 13 were left to grow. It is advised to allow 9 or 10 leaves to develop on plants of the cross between the Salento and Italia varieties. The weight of the crop increased with the increase of potash given in the fertilizer, but this increase was not sufficient to cover the expense of the application. The production of a second crop did not cover expenses and indicated the difficulty of maturing plants in the fall.

The typical variety of Nicotiana tabacum, G. E. ANASTASIA (*Bol. Tec. Coltiv. Tabacchi* [*Scafati*], *5* (*1906*), *No. 1–2–3, pp. 240, pls. 25, figs. 45, dgms. 3*).—Descriptions of different types and numerous varieties of tobacco are given and the leaf characters of many of them are noted. In addition the bulletin presents abstracts on experimental work with tobacco carried on in different countries and discussions of the cultural work with tobacco in different tobacco-growing sections of Italy.

Descriptive notes on typical varieties of wheat grown in New South Wales, F. B. GUTHRIE (*Agr. Gaz. N. S. Wales, 17* (*1906*), *No. 12, pp. 1173–1205, figs. 27*).—A list of 28 varieties are described with reference to their characteristics of growth and their milling qualities. The types represented include the Farrer cross-bred wheats, comprising improved soft, weak-flour wheats and strong-flour wheats. A number of durum wheats are also included in the list.

HORTICULTURE.

Laboratory work in plant breeding, R. A. EMERSON (*Ann. Rpt. Nebr. Hort. Soc., 37* (*1906*), *pp. 277–282*).—The importance of laboratory work in teaching the subject of plant breeding is pointed out and suggestions given on the value of practical work along this line to the student and on the use of material for hybridization such as peas, beans, squash, pumpkins, etc.

Fertilizing garden crops with lime-nitrogen (*Deut. Landw. Presse, 34* (*1907*), *No. 5, p. 30, figs. 7*).—Some data are given showing the results secured in fertilizing onions and cucumbers with lime-nitrogen, either alone or combined with other fertilizers, and on various soils. With onions it proved more efficient in increasing the yields than either nitrate of soda or sulphate of ammonia. With cucumbers any omission of lime-nitrogen in the formula used resulted in decreased yields. It is claimed that lime-nitrogen is as suitable for fertilizing garden crops on all soils except sour moor and sterile sand as any of the usual forms of commercial nitrogen.

A new muskmelon (*Cal. Cult., 28* (*1907*), *No. 2, p. 25, figs. 3*).—An account is given of a new variety of muskmelon, having a hard shell not unlike that of the Hubbard squash, but less than ¼ in. in thickness, of good quality, and especially promising as a winter melon. The melon contains practically no seed cavity, the seeds being embedded in the pulp. The flesh is light yellowish green in color, without fiber, and of an unusually good flavor. It is thought it will be of especial value as a late fall melon long after the casabas are gone, coming into the market about Christmas time, and it is believed that its firm shell will permit of its being shipped all over the United States. The melon has not yet been named.

Chillies or capsicums, W. R. BUTTENSHAW (*West Indian Bul., 7* (*1906*), *No. 3, pp. 213–221*).—Quite an extensive account is given of the culture of chil-

lies in different countries of the world, with a review of the more recent literature on the subject and specific directions for cultivation.

Study on Rheum rhaponticum, U. CRISTOFOLETTI (*Inaug. Diss., Univ. Bern, 1905, pp. 63, pls. 5*).—A brief historical account is given of rhubarb from the standpoint of its use in medicine, with the results of a chemical study of the plant from the standpoint of the druggist.

Horticultural section, W. J. PALMER (*New Zeal. Dept. Agr. Ann. Rpt., 14 (1906), pp. 247–255, pls. 16*).—An outline of the horticultural work carried on during the year at the Momohaki experiment station with different fruits and vegetables. The Northern Spy apple has been found especially desirable as an apple stock because of its fibrous-rooted nature and its total resistance to aphis. Trees which have borne practically no fruit on Paradise stocks when grafted on Northern Spy stocks have borne well every season, and the union has been more perfect than on the Paradise stocks.

Hypodermic injections in plants (*Gard. Chron., 3. ser., 41 (1907), No. 1045, p. 8*).—An account taken from the *Journal de la Société Nationale d'Horticulture de France* is given of the work of J. M. Simon in injecting nutritive fluids into the stems of trees and other plants as a means of rejuvenation. For trees a receptacle containing the fluid to be injected is placed at a height of about 6 ft. above the ground level. From this a pipe is carried down nearly to the level of the soil, to which a funnel-shaped curved tube is attached at the base and made to penetrate the young wood at the roots of the tree. By this means a certain amount of pressure is secured.

The work has been carried on with apples, peaches, vines, and potatoes. In the case of the peach purin was injected mixed with water, as a result of which a decrepit tree was made to grow vigorously. Other materials used were nitrate of potash and certain chemical solutions closely resembling sap in composition. By this method of treatment peach trees that had previously been attacked with blister dropped their leaves and produced new ones which were unaffected by the fungus. A solution of copper sulphate injected into vines resulted injuriously in part, but with the aid of copious waterings the leaves partially recovered, and at the end of the experiment neither Oïdium nor mildew was to be seen either on the foliage or berries.

A like arrangement was used in injecting fluid into cabbage, cauliflowers, and potatoes, the receptacle containing the liquid being at a height of from 3 to 4 ft. above the collar of the plant, at which place the funnel-shaped cannula was inserted.

The importance of lime as a plant food for seedlings, VON BREHMER (*Gartenwelt, 11 (1907), No. 14, pp. 163, 164, fig. 1*).—The author points out the greater use that seeds in germination and first growth make of lime over potash or phosphoric acid and gives the results of a germination test with seeds of a number of varieties of flowers with and without lime. In every instance a much larger germination percentage was secured where an abundance of lime was present.

Relative to the use of lime it is stated that if quicklime is used it should be applied to the soil at least 8 weeks before the seed is planted. The carbonate, on the other hand, can be applied within a day of planting without injurious results. In any case the lime should be thoroughly well mixed with the soil before the seeds are planted.

Plant breeding in relation to American pomology, W. M. MUNSON (*Maine Sta. Bul. 132, pp. 149–176*).—A brief account is given of the methods of work heretofore employed in plant breeding as related to the development of American fruits. The results accomplished up to the present time in breeding straw-

berries, grapes, pears, apples, plums, blackberries, etc., are noted and a number of the unsolved problems now confronting American pomologists mentioned. The author holds that the practice of propagating our common fruits as followed by most nurserymen is radically wrong, tending to deterioration of varieties rather than to improvement, since buds are often selected promiscuously from either bearing or barren trees and from nursery stock of unknown character.

Results from work in breeding hardy fruits, C. G. PATTEN (*Ann. Rpt. Nebr. Hort. Soc., 37 (1906), pp. 269–273*).—The author began breeding hardy fruits, particularly apples, in the West about 1869. An acount is given of this work, resulting in the production of the Patten greening apple and the securing of many important seedling apples of large size and good quality. The author has been able to secure a cross between the native Soulard crab and a Pippin apple.

Crop improvement by utilizing wild species, C. E. BESSEY (*Ann. Rpt. Nebr. Hort. Soc., 37 (1906), pp. 116–123*).—In securing new crops for agricultural purposes from wild plants the author calls attention to the value of our various species of native grapes, wild wheat grasses, wild barley, blue grama grass, bird-foot clover (*Lotus americanus*), buffalo peas (*Astragalus crassicarpus*), tomato cherries (*Solanum triflorum*), ground nuts (*Apios apios*), prairie apple (*Malus ioensis*), dwarf wild cherry (*Prunus demissa*), Nebraska sand cherry (*P. besseyi*), buffalo berry (*Lepargyraea argentea*), low sumach (*Rhus trilobata*), and hawthorns.

A curious effect of grafting by approach, A. NOMBLOT (*Jardin, 20 (1906), No. 476, pp. 373, 374, fig. 1*).—An account is given of grafting by approach the variety of pear Mme. Chaudy on Beurre Superfin. A branch on the stock coming out below the graft produced fruit similar in form and qualities to that produced on the scion, due it is thought to the reciprocal action of the scion. An illustration is given showing this similarity in form of the fruit.

Fruit varieties most popular on the Pacific Slope, E. J. WICKSON (*Pacific Rural Press, 72 (1906), No. 25, p. 392*).—The author sent a circular of inquiry to nurserymen throughout the State of California as to the most popular varieties of fruits they were propagating. The answers to these have been tabulated for apples, apricots, cherries, grapes, peaches, pears, plums, and prunes.

Peach growing in Texas, E. J. KYLE (*Texas Sta. Bul. 80, pp. 29, figs. 15*).—Detailed directions with numerous illustrations are given for all the various phases of peach culture as observed in Texas.

Relative to the cropping of young peach orchards the author states that the results of two years' tests at the station indicate the following rotation as best: An early maturing crop that will come off the land about June 1, followed by cowpeas, peanuts, sweet potatoes, or some crop that will mature late in the summer. After the first crop is taken off the soil is thoroughly broken and pulverized and the soil on each side of the trees kept stirred until about September 1.

"The advantage of planting such crops as Irish potatoes, tomatoes, etc., is that the soil is well fertilized, having more plant food added than is removed by the crop. Then again these crops come off early, so that the soil can be gotten in fine condition before the second crop is put on. By this method the soil is kept stirred throughout the summer and the trees are kept going until September."

Olive pickling, F. T. BIOLETTI (*California Sta. Circ. 24, pp. 14, figs. 12*).—A discussion is here given of the value of olives as food, with details of the best methods of gathering, sorting, grading, pickling both ripe and green olives,

and preserving by heating, with an account of varieties best suited for the different purposes. The bulletin is based on earlier publications of the station (E. S. R., 14, p. 441).

Growing oranges forty years, H. M. STRINGFELLOW (*Texas Farm and Ranch, 25 (1906), No. 51, p. 11*).—The author has grown oranges in southern Texas since 1865, and in this article gives the results of his experience during the time. Generally speaking, the results have been unfavorable, as about the time the trees were coming into bearing they were killed by exceptionally cold winters. The dates of these various killing winters are recorded in some detail.

Date palm, F. FLETCHER (*Dept. Land Rec. and Agr. Bombay, Bul. 28, pp. 17*).—The object of this publication is to encourage the culture of the date palm in India.

Detailed discussion is given of the conditions necessary for the culture of the date palm, with an account of the attempts that have been made in India to improve and extend its culture, including the present aspect of the situation. Besides a discussion of all the usual cultural details, tabular data are given for a large number of well-known varieties as regards production, name of variety, time of ripening, soil required, principal markets, etc.

Mangoes, J. B. BEACH (*Fla. Agr., 33 (1906), No. 47, p. 793*).—The author gives his experience extending over a number of years in grafting and budding mangoes. Contrary to the results secured by Oliver, who prefers budding (E. S. R., 16, p. 365), he has found inarching with pot-grown trees the only practical method of propagating nursery stock.

California crop statistics 1905–6 (*Cal. Fruit Grower, 34 (1906), No. 963, p. 5*).—The almond yield for the year 1905–6 is placed at 2,100 tons, beet-sugar output 64,210 tons, brandy production 4,070,992 gal., canned fruit and vegetable pack 4,475,751 cases, citrus fruit shipments 27,610 cars, cured fruit and raisin output 120,700 tons, honey yield 10,000,000 lbs., hop crop 73,000 bales, prune output 62,500,000 lbs., raisin yield 90,000,000 lbs., vegetable shipments 67,900 tons, walnut yield 6,400 tons, and wine production 26,502,310 gal. The entire issue of the *Fruit Grower* is devoted to a review of the production of different crops in California and, in some cases, elsewhere during the year 1905–6.

Cocoanuts, P. HUBERT (*Le Cocotier. Paris: H. Dunod and E. Pinat, 1906, pp. XIII+133, figs. 39*).—A popular treatise on the establishment of cocoanut groves, cocoanut culture, and the production of copra, cocoanut oil, dried cocoanut, fiber, etc., with descriptions of the various forms of machinery used in preparing different cocoanut products for market.

The cacao plantation in French Congo, C. CHALOT and M. LUC (*Le Cacaoyer au Congo Français. Paris: Bibliotheque D'Agriculture Coloniale, 1906, pp. 59, figs. 35, map 1*).—A discussion of the commercial importance of cacao to the French colonies, and an account of its culture in French Congo.

The importance of shade trees in cacao culture, C. J. J. VAN HALL (*Inspectie Landb. West-Indië, Bul. 7, pp. 20*).—An extended account, based on the results of observation and experiments, is given of the importance of shade in cacao culture.

The value of shade is attributed to a number of factors, the more important of which are the keeping of the ground cool, the preservation of the soil moisture, better physical condition of the soil brought about by the decaying leaves and the growing roots of the trees, and the greater fixation of nitrogen in the soil. The shade trees are also of value as a windbreak.

The general conclusion is drawn that cacao trees will flourish in full sunlight and give increased yields, but in that case all of the benefits which arise

from shade must be supplied by the use of some intercultural crop or by manuring. The question as to the better method of culture from a practical standpoint, therefore, resolves itself into which method is the more economical in any particular case.

The varieties of cultivated pepper, C. A. BARBER (*Dept. Agr. Madras Bul. 56, pp. 123–133, pls. 3*).—A botanical account is given of the principal species and varieties of cultivated black pepper vines. The 3 main types of good vines are the Balamcotta, Kallivalli, and Cheriakodi. These classes with the several varieties coming under each are described. Plates are also given showing pepper flowers and fruits of the different classes.

Every farmer can raise evergreens, C. S. HARRISON (*Twentieth Cent. Farmer, 1907, No. 317, p. 9, figs. 3*).—As a result of 35 years' experience in the semiarid regions of the West the author states that in growing seedlings of the ponderosa or bull pine, the best results are secured if they are grown in the open sunlight. If grown under screens they are likely to damp off and it is difficult to get a good stand.

Generally speaking, the seed should be sown in the fall, but spring sowing can be made if the seed is first soaked in warm water, the water being changed every 12 hours and the seed kept in a warm place. Thus treated, the seed will sprout within 3 or 4 days, when it should be planted in a well-prepared bed and covered with an inch of sand or fine earth. The soil must be kept moist until the plants come up.

Seed two or three years old has been found as satisfactory as new seed. About a pint is used to each 8 feet square of bed surface. In digging up the trees he advises that the roots be obtained full length. Fair success has been obtained by digging the trees from the seed beds when 4 years old, but preference is given to plants 1 to 2 years old.

The action of ether in forcing plants (*Amer. Florist, 27 (1906), No. 968, pp. 1051, 1052*).—This is a translation of an article taken from Revue Horticole giving an account of 5 different experiments in the use of ether for forcing plants.

In preparing lilacs for forcing it is stated that they are dug up about October 15, when the buds are well formed, with a ball of earth attached and left in the open if the weather be dry, or put under sheds if it rains. In either case, the leaves are left upon the branches. After 2 to 4 days, when the plants wilt and the bark begins to wrinkle, all the leaves are cut off, leaving the stems, which are not easily removed. The plants are stored 7 or 8 days in a dry place and then taken into the greenhouse for forcing.

Generally speaking, the action of the ether was found to vary greatly, depending upon whether the plants were rested or not. With rested plants etherization hastened the blooming period but a few days, while with nonrested plants it reduced the forcing period by half and gave far better blooms.

At a temperature of 60° and a dry atmosphere 3 to 4 oz. of ether per cubic yard was found sufficient, while in a moist atmosphere up to 8 oz. was used with impunity. The duration of the etherization process should correspond with the time necessary for a complete evaporation of the ether used. In a dry atmosphere the temperature should not be over 60 to 65°, but if the air is moist, 70 to 77° is not too warm.

Etherization appears to be most effective with lilacs. Much less favorable results were secured with snowballs, *Azalea mollis*, and *Deutzia gracilis*. In 3 tests with lily of the valley, the first growth appeared quite rapid, but the blooming period was in no case hastened more than 48 hours.

FORESTRY.

Forest planting in eastern Nebraska, F. G. Miller (*U. S. Dept. Agr., Forest Serv. Circ. 45, pp. 32*).—A study was made of the forest plantations in eastern Nebraska to ascertain the species of trees best suited for planting throughout the region. The plantations already in existence were studied with reference to their silvicultural requirements, the amount and value of wood products grown, and the effect of different methods of planting.

The planting of forests has decreased in eastern Nebraska in recent years, and some of the earlier planted forests are being cut off. Tables are given showing the height and diameter growth of the principal species of trees planted in eastern Nebraska over a period of 50 years, the amount of heart wood in trees of various diameters, and the yield of cottonwood on bottom land and on upland, as well as the yield of catalpa, green ash, black walnut, honey locust, osage orange, white willow, silver maple, box elder, Russian mulberry, white elm, Lombardy poplar, black locust, and various other species of broadleaf trees and of pines.

The data obtained show that hardy catalpa, osage orange, black walnut, cottonwood, white willow, green ash, and honey locust can be grown with profit in eastern Nebraska. "Hardy catalpa, osage orange, and green ash should be planted chiefly for fence posts, white willow for fuel, black walnut for lumber, and cottonwood for fuel and lumber. All attain their best development in rich, well-drained valleys. Cottonwood, white willow, and black walnut are essentially bottom-land trees. Osage orange should be planted on upland only in fertile soils in southeastern counties. The range of hardy catalpa in upland planting is considerably wider, but it must have good soil. Green ash and honey locust are especially adapted for dry upland planting in the more western and southwestern counties. . . . In the sand hills some of the conifers, such as western yellow pine and jack pine, undoubtedly may be planted with profit, since land values are certain to remain low."

Holding force of railroad spikes in wooden ties, W. K. Hatt (*U. S. Dept. Agr., Forest Serv. Circ. 46, pp. 7, figs. 4*).—Tests were made to compare the relative holding force of common, channeled, and common screw spikes, and Illinois Central screw spikes, when driven into railroad ties of both hard and soft woods in different states of seasoning and when treated with preservatives. The common spikes weighed 165 to the 100 lbs., common screw spikes 85 to the 100 lbs., channeled spikes 200 to the 100 lbs., and Illinois Central screw spikes 85 to the 100 lbs. The results of the tests are given in tabular form.

As regards the common screw spikes the tests show that they resisted withdrawing with from 2 to 3 times the force of the common spikes, the resistance being most marked in the softer woods. In soaked loblolly pine the channeled spikes had about 60 per cent of the holding power of screw spikes and about 12 per cent more holding power than common spikes. The common screw and Illinois Central screw spikes had practically the same holding power in loblolly pine.

The holding power of seasoned ties was found to be greater than that of steamed ties. With common spikes knotty ties had about 25 per cent less holding power than clear ties. With the screw spikes, on the other hand, a knotty tie had 35 per cent greater holding power than a clear one. The holding power of a natural tie and of one steamed for 4 hours at 30 lbs. pressure was found to be about the same. "Steaming for 4 hours at less than 30 lbs. appears to increase the holding power, while steaming for more than 4 hours at 20 lbs. decreases it. Ties steamed and creosoted or steamed and treated with zinc chlorid appear to have less holding power than those simply steamed."

Strength of packing boxes of various woods, W. K. HATT (*U. S. Dept. Agr., Forest Serv. Circ. 47, pp. 8, figs. 5*).—The merits of Michigan white pine, New England white pine, loblolly pine, western spruce, western hemlock, cottonwood, and red gum as box material were tested.

The lumber used was of average quality, containing about 11 per cent moisture with only sound, live knots, and without sap stains. Three sizes of boxes were made up—large, holding up to about 600 lbs. of dry goods; medium, corresponding to those used for hardware, soap, or canned goods, up to 250 lbs., and small, holding up to 100 lbs. Four styles of boxes were also used, (1) plain without battens, (2) four square battens on each end, (3) four bevel battens on each end, and (4) two battens on each end. In testing, the load was applied along the diagonal of the box, an action similar to that which occurs when the box is dropped on one of its corners. In case of small boxes the load was also applied along the entire length of the edge of the box.

The results of the tests show that of the woods tested "cottonwood was the strongest for medium and large boxes and red gum for boxes of small size. For all sizes cottonwood and red gum occupied the first two positions in regard to strength. The weakest wood differed for each kind of box. For the large size it was western spruce, for the medium size Michigan white pine, and for the small size North Carolina pine." When, however, the strength of the boxes per unit of weight was considered the cottonwood as before stood first, white pine standing second for boxes of large size. For small size, however, cottonwood, red gum, western spruce, and western hemlock showed greater strength than white pine.

The experiments also showed that thin end boards could not be substituted for end boards of standard thickness without reducing the strength of the box. With small boxes of New England pine the strength of lock-cornered boxes exceeded that of dovetailed boxes, while the latter were stronger than nailed boxes. Other tests showed that the majority of nails at the end of the side, top, and bottom boards should be driven into the end boards rather than into the battens.

Kiln-drying hard-wood lumber, F. DUNLAP (*U. S. Dept. Agr., Forest Serv. Circ. 48, pp. 19, figs. 4*).—The author describes the systems of kiln-drying hardwood lumber generally in vogue in this country, discussing at considerable length the theory of drying, and points out a number of unsolved problems in this industry. The report is based on work with white oak, red oak, maple, birch, basswood, chestnut, ash, red gum, mahogany, cherry, and walnut.

It was found that the time consumed in kiln-drying these woods varies greatly among different operators. White oak, for instance, is generally dried from 1 to 2 weeks, yet some operators double this period, and others reduce it to from 3 to 5 days. The length of time that each species should be dried varies widely with a number of conditions. Thus "quarter-sawed oak usually requires half again as long as plain oak, mahogany requires about the same time as plain oak, ash dries in a little less time, and maple, according to the purpose for which it is intended, may be dried in one-fifth the time needed for oak, or may need a slightly longer treatment. For birch the time required is from one-half to two-thirds and for poplar and basswood from one-fifth to one-third as long as that required for oak."

The cost of kiln-drying among different operators was found to be from 75 cts. to $5 per thousand feet.

It appears from the investigations that dry kilns are constructed and operated at the present time largely without careful system. Many of the present defects in kiln-drying resulting in warping, twisting, checking, case-hardening,

and honeycombing are pointed out, and the principles to be followed in constructing kilns are laid down. Broadly speaking, a system of heaters and radiators in a rightly constructed kiln should be capable of maintaining the desired temperature at all times. "The temperature and humidity of the drying chamber should be under perfect control and protected from outside influences. Simple devices should control the circulation as desired, both between the kiln and the outer atmosphere and between the two ends of the kiln. Toward the end of the process abundant and vigorous circulation should be provided for, due care being taken not to lower the temperature."

The subjects of moist-air drying, preliminary seasoning, preliminary use of steam in the kiln, prolonged submersion of the wood in water, etc., are also discussed.

Timber used in the mines of the United States in 1905, R. S. KELLOGG (*U. S. Dept. Agr., Forest Serv. Circ. 49, pp. 8*).—Of 14,000 mines to which inquiries were sent regarding the use of timber, 5,000 reported that timber was used and nearly 9,000 reported no use of timber.

From the data obtained, which it is calculated covered fully 90 per cent of the total amount of timber used during the year, a total of 165,535,900 cu. ft. of round timber and 435,944,000 board feet of sawed timber is shown. Or if the round timber be reported in board feet the total for use in mines would be 2,422,374,800 board feet. The quantity of timber used in the different kinds of mines, such as bituminous and anthracite coal, iron mines, and mines for precious metals, is shown for each of the different woods in tabular form. The principal mine timbers, both round and sawed, are pine and oak. The total cost of the timber used during the year was $16,500,000.

The States in which the cost of mining timber exceeded $500,000 are Pennsylvania, Montana, Arizona, Illinois, Michigan, West Virginia, Colorado, and California.

Wood used for distillation in 1905, H. M. HALE (*U. S. Dept. Agr., Forest Serv. Circ. 50, pp. 3*).—Statistics secured from 82 distillation plants in the United States are given, showing the amount of wood used and the products produced. The total amount of wood used was 676,739 cords, resulting in 26,670,139 bu. of charcoal, 5,062,076 gal. of alcohol, 86,685,129 lbs. of acetate of lime, 238,180 gal. of turpentine, and 1,039,980 gal. of tar and oil, besides 434,780 gal. of oil from pine distillation. The chief States in which woods are used for distillation purposes are Pennsylvania, Michigan, and New York. The quantity of pine distilled and its products were insignificant when compared with those of hard-wood, there being but 16,969 cords of pine distilled.

Wood used for veneer in 1905, H. M. HALE (*U. S. Dept. Agr., Forest Serv. Circ. 51, pp. 4*).—Data received from 128 manufacturers of veneer in the United States were compiled for the year 1905.

More than 189,000,000 ft. log measure is used for veneering purposes. Of the veneer stock produced in 1905 21.8 per cent was made from red gum, 14.5 from maple, 14.4 from yellow poplar, 9 from cottonwood, and 8.9 from white oak. About one-third of the establishments used no artificial process in drying. Thirty-nine establishments used the cores from the rotary process in veneer making for fuel, and 33 converted them into excelsior. In one instance they were used for pulp, in another for porch posts, and in others for crates, boxes, and baskets.

The lumber cut of the United States in 1905, S. R. KELLOGG (*U. S. Dept. Agr., Forest Serv. Circ. 52, pp. 23, figs. 3*).—Statistics for the lumber cut in the United States in 1905 were secured through cooperation with the National Lumber Manufacturers' Association and other lumber associations by correspondence.

The data secured show that 11,666 establishments cut 30,502,961,000 ft. of

lumber in 1905. In recent years there appears to be a decrease in the number of lumber establishments, with a gain in the individual output. The largest amount of lumber was furnished by yellow pine, followed by white pine, Douglas fir, hemlock, white oak, spruce, etc.

The amount of lumber produced by all the different species of trees in the various States is given in detail in tabular form, from which it appears that Arkansas leads in the production of red gum and cottonwood, California in western yellow pine and redwood, Idaho in western white pine, Indiana in hickory and walnut, Kentucky in yellow poplar, Louisiana in yellow pine and cypress, Maine in spruce and balsam, Michigan in maple, beech, and ash, Minnesota in white pine, Montana in larch, Pennsylvania in hemlock and chestnut, Tennessee in red oak, West Virginia in white oak, and Wisconsin in basswood, birch, elm, and tamarack.

The shingle cut in 1905 by 2,547 mills was 15,340,909,000, and the total lath cut in 1905 by 1,801 mills was 3,111,157,000.

Notes on the influence of forests on the storage and regulation of the water supply, S. EARDLEY-WILMOT ([*Indian*] *Forest Bul. 9, pp. 58, pls. 3*).—A summary is given of European research into the interrelation between forests and rivers, with a discussion of the application of results of European research to Indian conditions. Heretofore the forests of India have been managed without special reference to water supply and stream flow. The great desirability of considering this phase of the subject is pointed out at length. In the appendix the principal rivers of India are noted and extracts given from the proceedings of the American Forest Congress in 1905.

Forest litter and nitrogen, HORNBERGER (*Ztschr. Forst u. Jagdw., 38 (1906), No. 12, pp. 775–781*).—Further experiments are reported by the author (E. S. R., 17, p. 564) to determine whether decaying leaves in forests are able to increase their total nitrogen content by fixation of a certain amount of the free nitrogen of the air. The materials used were oak and hornbeam leaves. Data obtained in 8 different experiments are tabulated and the conclusion is drawn from the work that it is now certain that forest litter under favorable conditions can actually increase its nitrogen content by fixation from the free nitrogen of the air.

The effect of the moon's phases on the period of felling bamboos, E. P. STEBBING (*Indian Forester, 32 (1906), No. 11, pp. 534–540*).—It is commonly held by the natives of India that the felling of export bamboos or of poles should not be done when the moon is full, as otherwise, unless well soaked in a tank and subsequently well preserved by smoke they will be rapidly destroyed by boring insects, the most serious of which are *Dinoderus pilifrons* and *D. minutus*.

Four experiments are recorded in which bamboos were cut for a few days before and after the new moon and full moon and at different seasons of the year. In at least three of the experiments the results seemed to show that the season of cutting, whether before, during, or after full moon, had no effect on the susceptibility of the bamboos to the attacks of beetles.

Other results were secured which indicate that the cold weather months are the best ones in which to fell, the attacks of the borers being much less at this season, and further that bamboos stacked in the shade and covered up in such manner as still to allow the beetles getting at them were more severely attacked than those stacked in the open. The author believes that if bamboos are felled during November and the first half of December and immediately piled or stacked in the sun they will not be attacked by the borers.

Note on the chilgoza forests of Zhob and the Takht-I-Suliman, E. P. STEBBING ([*Indian*] *Forest Bul. 7, pp. 35, pls. 6, map 1*).—The author, while investigating the attacks of bark-boring beetles which were devastating the

chilgoza forests in Baluchistan, made extensive notes on the general character of the chilgoza forests of Zhob and of the Takht-I-Suliman, and advocates that these forests be protected by the government. The forests are described and a map given of them, with an account of the forest growth, and suggestions for their better management.

Caoutchouc in Indo-China, C. and A. SPIRE (*Le Caoutchouc en Indo-Chine, Paris: A. Challamel, 1905, pp. VIII+262, pls. 35, map 1*).—Part 1 of this work is devoted to the botany of the caoutchouc-producing plants of Indo-China; part 2 to a study of the chemistry and industrial uses of the caoutchouc from different species, and an account of methods of harvesting and of the commercial importance of the industry. The appendix contains various tables showing the value of different moneys, weights and measures, etc., with a bibliography of over a hundred papers on the subject.

Contribution to the chemistry of gutta-percha and caoutchouc, O. MÜLLER (*Inaug. Diss., Univ. Bern, 1905, pp. 87, figs. 6*).—This paper presents the results of extensive investigations into the chemical nature of gutta-percha and caoutchouc.

DISEASES OF PLANTS.

Plant diseases in Bulgaria, K. MALKOFF (*Ztschr. Pflanzenkrank., 16 (1906), No. 4, pp. 212, 213*).—An abstract of a report of the royal agricultural experiment station at Sadovo, Bulgaria, the second part of which is taken up with studies of the various plant diseases.

Results are given of experiments for the prevention of grain smuts, in which the grain was treated with hot water, Bordeaux mixture, copper sulphate solution, formaldehyde, and dry air. The most efficient treatments were those in which formaldehyde was used.

In examining the susceptibility of the native varieties of wheat to smut the author reports that the hard wheats (*Triticum durum*) were most attacked, as much as 83 per cent being smutted, while the soft wheats ranged from 26 to 44 per cent. It was also found that neither late nor early seeding had any effect on the amount of smut present.

In continuation of his investigations on the bacterial disease of sesame (E. S. R., 17, p. 1166), the author reports that 2 species of bacteria are present. Soaking the seed in a 0.1 per cent solution of formaldehyde for 4 hours was found to have an excellent effect in preventing this disease.

Notes are given on the attack of chick-peas by *Ascochyta pisi*, which may be controlled by spraying with a 1 per cent solution of Bordeaux mixture, and on the leaf curl due to *Exoascus deformans*, which may be prevented by spraying with a 3 per cent solution of Bordeaux mixture. A bacterial disease of mulberries and a new disease of plums, which is causing considerable injury, are subjects for further investigation.

Report of the section of plant protection of the Royal Servian agricultural chemical experiment station at Belgrade, 1903–1905, N. RANOJEWIĆ (*Ztschr. Pflanzenkrank., 16 (1906), No. 4, pp. 207–212*).—In 1902 there was established in connection with the agricultural chemical experiment station of the ministry of agriculture a section for plant protection, and the present is the first report of the investigations carried on by this section.

One of the principal subjects investigated has been the downy mildew of grapes (*Plasmopara viticola*), for combating which experiments have shown that spraying with Bordeaux mixture has proved efficient. Notes are given on a number of other fungus diseases and insect enemies of economic plants.

Agricultural botanical report for 1906, J. ERIKSSON (*K. Landtbr. Akad. Handl. och Tidskr., 45 (1906), No. 3–4, pp. 237–298*).—Descriptions of the fol-

lowing plant diseases which have recently appeared in Sweden are given, with directions for eradicating or combating them: American gooseberry mildew (*Sphærotheca mors-uvæ*), American grape mildew (*Oïdium tuckeri*), cabbage club root (*Plasmodiophora brassicæ*), eelworms on oats (*Tylenchus devastatrix*), leaf mildew on briar roses (*Peronospora sparsa*), and raspberry blight. The report also contains a discussion of the vegetative life of grain rust fungi in the growing plant, and of international cooperation for protection against and the combating of plant diseases. A summary of experiments completed during the year, or in progress, at the Royal Agricultural Academy of Sweden, and a list of publications for the year complete the report.—F. W. WOLL.

Report of the government botanist, C. A. BARBER (*Rpt. Dept. Agr. Madras, 1905–6, pp. 43–48*).—In addition to the routine report relating to collections, economic plants, etc., the author briefly describes some fungus diseases of sugar cane, peppers, peanuts, and Palmyra palms.

A study of some species of Fusarium and the plant diseases they cause, O. APPEL and G. SCHIKORRA (*Arb. K. Biol. Anst. Land u. Forstw., 5 (1906), No. 4, pp. 155–188, pl. 1, figs. 3*).—The results of a study of Fusarium diseases of a number of leguminous plants are given.

The St. John disease of peas, which has previously been noted (E. S. R., 15, p. 375), is described at some length, particular attention being given to the morphology, physiology, and chemical relations of the organism, which is recognized as *Fusarium vasinfectum pisi*.

Other wilt diseases of leguminous plants are more briefly described, among them a wilt of lupines and a Fusarium disease of vetch. The lupine disease is said to be caused by a form of *F. roseum*, and a technical description of the organism is given.

A summary of preventive treatments is given which includes care in selecting seed, avoiding the use of poorly germinating seed, the complete destruction of infected plants when observed, cultivation of resistant varieties, and the rotation of crops.

Monograph of the genus Ravenelia, P. DIETEL (*Bot. Centbl., Beihefte, 20 (1906), 2. Abt., No. 3, pp. 343–413, pls. 2*).—This is a monograph of the genus Ravenelia, a group of fungi parasitic on various species of euphorbiaceous and leguminous plants. The author notes the morphology of the fungi, their life history, geographic distribution, etc., after which he describes the 81 recognized species. A list is given of a number of isolated uredo forms which the author thinks probably will be ultimately found associated with species of Ravenelia.

A new fungus of cereals, J. R. JUNGNER (*Ztschr. Pflanzenkrank., 16 (1906), No. 3, pp. 131–135, pl. 1*).—The author reports observing numerous sclerotia of a fungus on the leaves of winter rye and wheat. Subsequent studies revealed the fruiting bodies of the fungus, which proved to be hitherto undescribed. The fungus seems to be associated with attacks of *Hylemyia coarctata*, one of the wheat flies. A technical description of the fungus (*Psilocybe henningsii* n. sp.) is given.

Wheat mildew, C. T. MUSSON (*Agr. Gaz. N. S. Wales, 17 (1906), No. 12, pp. 1222–1224, fig. 1*).—The author reports having observed considerable injury to wheat in Australia, which is due to the mildew *Erysiphe graminis*. This fungus is well known on a number of species of grass, but this seems to be the first report of its occurrence on wheat in Australia. The variety Federation seems to have been badly attacked, as upon the diseased plants no grain was formed and the straw was rendered almost useless.

Some experiments on the germinative ability of old ergot sclerotia, ZIMMERMANN (*Ztschr. Pflanzenkrank., 16 (1906), No. 3, pp. 129–131*).—Studies were

made both in the greenhouse and in the open air to determine the germinative ability of old sclerotia of the common ergot (*Claviceps purpurea*).

It was found that sclerotia more than 2 years old had lost all power of germination. Those remaining dormant the first year germinated readily the second year and at about the same time as fresh sclerotia. Moldy and broken sclerotia often retain a high percentage of their viability. Contrary to the popular belief that ergot must be kept moist over winter or it will not germinate, the author found that neither sowing in dry soil nor keeping the sclerotia in glass jars until time for experimental sowing diminished their germinative ability.

The time at which the development of promycelium and conidia takes place is approximately the same every year and corresponds with the normal flowering period of the cereals on which the fungus is a parasite.

Potato diseases, E. LANGE (*Die Kartoffelkrankheiten. Leipsic: O. Schneider, 1905, pp. 12, figs. 3, charts 3*).—This is a brief descriptive guide to accompany the colored charts which illustrate various diseases of potatoes, among them the potato rot, black shank or stem rot, leaf curl, scab, wet and dry rot of tubers, bacterial rot, nematodes, etc.

A contribution to the knowledge of potato scab, H. T. GÜSSOW (*Ztschr. Pflanzenkrank., 16 (1906), No. 3, pp. 135–137, pl. 1*).—A discussion is given of the form of potato scab that has been variously referred to as *Rhizoctonia violacea* and *R. solani* (E. S. R., 14, p. 159; 16, p. 788; 18, p. 151). The author claims that these 2 species of Rhizoctonia are identical, and from his own observations and those of Rolfs (E. S. R., 16, p. 788), he is convinced that the perfect form of the fungus is *Corticium vagum solani*.

A bacterial rot of the potato caused by Bacillus solanisaprus, F. C. HARRISON (*Centbl. Bakt. [etc.], 2. Abt., 17 (1906), Nos. 1–2, pp. 34–39; 3–4, pp. 120–128; 5–7, pp. 166–174; 11–13, pp. 384–398, pls. 8*).—The bacterial rot of potatoes has been more or less prevalent in the province of Ontario during the past 5 or 6 years and was particularly troublesome in 1904 and 1905. This disease resembles somewhat that described as being rather widespread in Germany and which is also known in England under the name of black shank disease (E. S. R., 15, p. 374).

Usually the first symptoms of the disease appear when the plants are in full vigor of growth, when a plant here and there in the field presents a sickly appearance, with drooping leaves somewhat discolored or yellowed. In a few days the stems lose their erect appearance and gradually fall to the ground, the whole stem and leaves finally shriveling up. When the leaves are turning yellow, black areas may be seen on the stems and petioles; and if these are cut through, the vibrovascular bundles and adjacent tissues will be found black or brown, depending on the progress of the disease. The stems are usually most discolored or blackened near the ground, but sometimes the discoloration is higher up the stem.

The tubers show the most characteristic indications of the disease, and when the plant appears to be in a fairly healthy condition the tubers may be badly diseased. Potatoes which appear sound if carefully examined will show discolored areas somewhat like a bruise, and as the disease progresses the flesh beneath the darkened portion becomes soft. On breaking the skin a white turbid liquid can be pressed out, which rapidly turns black on exposure to the air. In later stages of the disease the flesh softens to a watery pulp and becomes highly offensive, with a putrefactive odor. If potatoes are dug and stored in cellars or pits the disease continues to spread.

The author has found constantly associated with this disease an organism to which the name *Bacillus solanisaprus* is given. This has been isolated,

and its morphological and biological characters, as shown in pure cultures in various media, are described at considerable length.

Inoculation experiments have been made on a number of plants in addition to the potato, and it was found to successfully inoculate the tomato, ground cherry, peppers, and cucumber, but failed to produce any results, the wounds quickly healing on the eggplant, thorn apple, petunias, and a number of other plants more or less related to the potato.

The disease seems to be quite prevalent throughout Canada, and in 1905 it is estimated to have caused losses amounting to $720,000.

Investigations show that undoubtedly the principal means of infection comes from the diseased condition of the seed potato when planted. If the organism is in the soil, infection apparently may be produced through the seed tuber, and infection may also be produced through wounds, as has been repeatedly demonstrated. The moisture of the atmosphere and soil are shown to be conditions which influence the spread of the disease.

It has been found that certain varieties of potatoes under field conditions are more immune than others, and as methods of prevention the author suggests the planting of rot-resistant varieties, the use of seed potatoes that are free from disease, planting in well-drained land, reducing insect injury by the use of Paris green or other insecticides, preventing the growth of fungi by the use of Bordeaux mixture, and, finally, the rotation of crops.

The heart rot of beets, MERLE (*La Maladie du Cœur de la Betterave. Joigny: Hamelin, 1906; rev. in Prog. Agr. et Vit. (Ed. l'Est), 28 (1907), No. 1, pp. 26, 27*).—An account is given of a disease of sugar beets which is attributed to *Phoma tabifica* or *P. betæ*.

This disease it is said usually makes its appearance in the field between the middle of July and the end of August when here and there may be seen leaves which present a wilted appearance, as is frequently observed on a very hot day. The next morning the leaves instead of having a refreshed appearance are still wilted, and if examined the petioles will be found to be brown spotted, and the leaves finally die. Later the disease becomes quite evident on the root, ultimately causing its destruction.

The disease seems most frequent on sandy clay soils, and for combating it deep culture, particularly during the fall and winter, the application of wood ashes, long periods of rotation, and the planting of resistant varieties are recommended.

Sclerotinia libertiana as the cause of the rotting of root crops, O. APPEL and W. F. BRUCK (*Arb. K. Biol. Anst. Land u. Forstw., 5 (1906), No. 4, pp. 189–203, figs. 7*).—An account of the rotting of various root crops in cellars and storage pits, the injury being attributed to the presence of the fungus *Sclerotinia libertiana*. Descriptive notes are given on the fungus and a report made on the investigations regarding its host plants and methods for preventing its occurrence and spread in storage.

A grass-destroying myxomycete, T. WULFF (*Ztschr. Pflanzenkrank., 16 (1906), No. 4, pp. 202–206, pl. 1*).—An account is given of severe injury to various species of grasses by *Physarum cinereum*.

The clover broom rape, E. MARRE (*Prog. Agr. et Vit. (Ed. l'Est), 27 (1906), No. 49, pp. 681–690, figs. 7*).—Descriptions are given of *Orobanche minor*, an active parasite of clover, and attention is called to the necessity for careful cleaning of seed and the use of manures and fertilizers to prevent the spread of the parasite.

Eelworms, W. E. COLLINGE (*Univ. Birmingham, Dept. Econ. Zool. Circ. 1, pp. 4*).—Brief accounts of the root knot eelworm (*Heterodera radicicola*), which is exceedingly common and injurious to tomatoes, cucumbers, and other garden

crops, and the stem eelworm (*Tylenchus devastatrix*), which is reported as having been observed on numerous field crops and nursery stock. Notes on the life history of the different nematodes are given and preventive and remedial measures suggested for their control.

Experiments with tomato blight, H. B. ORR (*Northwest Hort., 20 (1907), No. 1, pp. 3, 4*).—An account is given of experiments carried on by the author which seem to indicate that the severity of attacks of tomato blight is increased in proportion to the potash content of the fertilizers applied to the crops.

Cranberry diseases, C. L. SHEAR (*George Washington Univ. Bul., 5 (1906), No. 4, pp. 75–78*).—An abstract of a thesis presented to the faculty of graduate studies of the university by the author, in which an account is given of cranberry diseases and experiments for their control.

The diseases described are the blast and scald caused by *Guignardia* sp., an anthracnose due to a species of Glœosporium, and a rot which is attributed to an undescribed genus of fungus, to which the name Acanthorhynchus is given.

For the control of these diseases the author states that experiments have shown that Bordeaux mixture is the most effective fungicide. Experiments carried on in 1904 showed that the percentage of disease could be very materially reduced by spraying, and in 1905, under more favorable conditions, plats which received 5 applications of the fungicide yielded only 6 per cent of rotten fruit, as compared with more than 91 per cent on unsprayed plats.

A popular bulletin on these diseases has been noted previously (E. S. R., 17, p. 51).

The bacterial disease of ginger, Y. UYEDA (*Centbl. Bakt.* [*etc.*], *2. Abt., 17 (1906), No. 11–13, pp. 383, 384, figs. 2*).—A brief note is given on a bacterial disease of *Zingiber officinale*, which has been under observation for about 3 years in Japan.

The organism has been isolated, and inoculation experiments show that it is capable of causing the disease. A study of the organism has shown that it is probably a new species closely resembling *Bacillus omnivorus*.

A further contribution to the infectious chlorosis of mallows, E. BAUR (*Ber. Deut. Bot. Gesell., 24 (1906), No. 8, pp. 416–428*).—In continuation of a previous paper (E. S. R., 18, p. 453) the author gives additional accounts of infectious chlorosis of a number of species of malvaceous plants. An immune strain of *Abutilon striatum* is described, and an account is given of the immunity of *Lavatera arborea*. The effect of light on the formation of virus of chlorosis in the leaves is discussed, after which the author describes experiments on the transmission of chlorosis by seed and also reports the occurrence of chlorosis on plants of other genera, particularly Cornus, Ligustrum, and Laburnum.

Soil treatment for the forcing house, A. D. SELBY (*Ohio Sta. Circ. 57, pp. 7, figs. 2*).—An account of investigations for the control of rosette (*Rhizoctonia* sp.) in lettuce and tomatoes and of nematodes in crops grown under glass.

Experiments have been carried on for 3 years in testing soil sterilization with steam and formalin, and the author has found that for the destruction of fungi in the soil the formalin treatment and the steam treatment appear to be of about equal efficiency. In the case of nematodes, steaming appears to be the only effective treatment, particularly for the destruction of the encysted forms of nematodes. Directions are given for the treatment of soil with formalin and steam, and the comparative advantages and disadvantages of each are pointed out.

Some causes contributing to the black rot of apples due to Sclerotinia fructigena, E. MOLZ (*Centbl. Bakt.* [*etc.*], *2. Abt., 17 (1906), No. 5–7, pp. 175–*

188, pls. 2, figs. 5).—A study is reported of the disease of apples called black rot that is due to the fungus *Sclerotinia fructigena*. Apples affected by this form of the disease are black and shiny and are often reduced to mummy fruits of unusual appearance. The shining black color of the apple is confined to the skin, the flesh below being the usual brown color characteristic of Monilia diseases.

The author cultivated the fungus on apples, pears, apple pomace, gelatin, etc., and describes the growth obtained. It was found that light and temperature were important factors in determining the development of the fungus. The character of the substratum on which the fungus grew was also an influencing factor, the skin of the apple appearing to retard the fructification to a considerable degree. In all the apples inoculated with cultures of the fungus the black rot developed after a time, although the fungus remained sterile. Low temperatures and deficiency of light were also found to induce sterility.

Melanose, Cladosporium, and Septosporium, P. Marsais (*Rev. Vit., 26 (1906), No. 677, pp. 621–623, pl. 1*).—Brief notes are given on diseases of grapes caused by *Septoria ampelina*, *Cladosporium viticolum*, and *Septosporium fuckelii*. These diseases ordinarily make their appearance so late in the growth of the vine that they occasion but little injury, but when these fungi attack the young leaves the use of fungicides, particularly those containing copper, is recommended.

Notes on the disease of grapes known as roncet, S. Ercole (*Bol. Uffic. Min. Agr., Indus. e Com. [Rome], 6 (1906), No. 4, pp. 373–381, figs. 3*).—The author reviews the various hypotheses regarding the cause of this disease, not arriving at any definite conclusion concerning them. Certain stocks seem quite resistant to roncet, and the author recommends their use in the vineyard. The most resistant stocks are American varieties or some of their hybrids, and by planting these and following more careful cultural methods, it is claimed that losses due to the disease may be greatly lessened.

Notes on folletage of the grape, L. Ravaz (*Prog. Agr. et Vit. (Ed. l'Est), 27 (1906), No. 49, pp. 690–692*).—In a note upon the occurrence of this disease in Asiatic Turkey the author calls attention to the probability that it is due to a species of Polyporus, which seems to be *P. igniarius*. While the evidence seems clear that the disease is due to this fungus, it has not yet been demonstrated experimentally.

The American gooseberry mildew, E. S. Salmon (*Jour. Roy. Hort. Soc. [London], 31 (1906), pp. 128–137, map 1*).—The author traces the spread of the American gooseberry mildew (*Sphærotheca mors-uvæ*) throughout Europe and suggests the need of legislation to combat its further dissemination.

The means employed to combat the American gooseberry mildew in Sweden, J. Eriksson (*Jour. Roy. Hort. Soc. [London], 31 (1906), pp. 138–141*).—Attention is called to the destructive nature of the gooseberry mildew (*Sphærotheca mors-uvæ*) on European varieties of gooseberries, and means that have been employed in Sweden for combating the disease are described. These include inspection of nurseries, the destruction of badly diseased plants, cutting out of infected portions of plants, and spraying with potassium sulphid.

Investigations on the bacteriosis of figs, L. Petri (*Atti R. Accad. Lincei. Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 15 (1906), II, No. 10, pp. 644–651, figs. 2*).—An account is given of a bacterial disease of fig trees which was formerly reported by F. Cavara as due to *Bacterium fici*.

The author in the study reported isolated the organism, cultivated it in various media, and successfully produced the disease through inoculation experiments. The cultural characteristics of the organism are described at

some length, and following a system of classification it is referred to *Ascobacterium luteum*.

From the descriptions of several bacterial diseases of olives, oleanders, etc., and parallel cultures of the organisms causing them, the author is led to believe that they are all due to the species of bacterium mentioned above.

A disease of coffee in Peru, L. HECQ (*Bol. Min. Fomento* [*Peru*], *4* (*1906*), *No. 9, pp. 30–39, pls. 2, fig. 1*).—An account is given of a disease of coffee due to *Stilbella flavida*. This fungus is said to be causing considerable injury in the coffee plantations of Peru, and suggestions are given for its prevention. These include the destruction of infected plants, spraying with Bordeaux mixture, clean cultivation, etc.

A disease of hazelnuts, H. C. SCHELLENBERG (*Ber. Deut. Bot. Gesell., 24* (*1906*), *No. 9, pp. 505–511, pl. 1*).—A description is given of a disease of the hazelnut in which the male catkins are attacked by a species of Sclerotinia. The effect produced upon the host plant is described and comparisons made with the disease caused by *Ciboria bolaris*. The author claims that the fungi are quite distinct, and as the one causing the disease in question has not been technically characterized, he proposes the name *Sclerotinia coryli* n. sp. for it.

A fungus disease of the cherry laurel, E. S. SALMON (*Jour. Roy. Hort. Soc.* [*London*], *31* (*1906*), *pp. 142–146, fig. 1*).—An account of the attack of the rose mildew (*Sphærotheca pannosa*) on the cherry laurel. This fungus, which is common on species of the genus Rosa, is said to occur only sparingly on other plants, but has been reported as attacking the peach, apricot, almond, and cherry laurel. Spraying with potassium sulphid or the application of flowers of sulphur is recommended for combating the disease.

A disease of fir, L. MANGIN and P. HARIOT (*Compt. Rend. Acad. Sci.* [*Paris*], *143* (*1906*), *No. 22, pp. 840–842*).—The attention of the authors was called during the summer of 1906 to a pronounced reddening of the leaves on a number of fir trees in the Jura region. The leaves had assumed a bright orange red color, which was in marked contrast with the dark green of the other foliage. The diseased leaves seemed to be more or less altered and in some cases the trees were badly affected.

An examination of the leaves showed the presence of a number of fungi, among them *Rhizosphæra abietis* n. g., *Macrophoma abietis* n. sp., *Cytospora pinastri*, and *Menoidea abietis* n. g. These different fungi which seem to be more or less associated with the disease are technically described and their probable relationships pointed out.

It is hoped by experimental studies to demonstrate the true cause of the disease, and inoculation experiments have already been begun with that end in view.

On the parasitism of Merulius lacrymans, O. APPEL (*Arb. K. Biol. Anst. Land u. Forstw., 5* (*1906*), *No. 4, pp. 204–206, figs. 2*).—A brief account is given of experiments by which the author sought to infect young seedlings of fir and pine with the dry rot fungus *Merulius lacrymans*.

The young trees were placed in pots, severe wounds made in the stems, and the mycelium of the fungus introduced, after which the plants were kept for several weeks in the moist atmosphere of the greenhouse. While the fungus grew abundantly, there does not appear to be any evidence that the dry rot fungus is able to live parasitically on young living coniferous trees.

A strangling disease of young birches, R. LAUBERT (*Arb. K. Biol. Anst. Land u. Forstw., 5* (*1906*), *No. 4, pp. 206–212, figs. 5*).—In the summer of 1905 attention was called to a great number of dead and dying birch seedlings. This led to an investigation of the cause of the trouble, and the author sep-

arated the following fungi from the diseased material: *Coniothyrium betulæ* n. sp., *Fusicoccum betulinum* n. sp., *Sporodesmium caverenarum* n. sp., and *Pestalozzi hartigii betulæ* n. var. Technical descriptions are given of the different fungi.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

General biology, O. Hertwig (*Allgemeine Biologie. Jena: Gustav Fischer, 1906, pp. XVI+649, figs. 371*).—This volume is a second and revised edition, with a change of title of the author's work on the cell and the tissues. The first edition, under the latter title, was published in two parts, while all the material is brought together in one volume in the new edition. The subject-matter has been extensively revised and brought up to date.

Rabbit destruction (*Jour. Dept. Agr. West. Aust., 14 (1906), No. 4, pp. 281–284*).—The value of rabbits for food is briefly discussed and notes are given on the great destruction caused by rabbits where they multiply too rapidly. It is proposed to introduce a carnivorous red ant from South Africa which is said to attack rabbits, particularly the young, and kill them within 24 hours after birth. An examination of the feeding habits of these ants is being made to determine whether it would be safe to introduce them.

The serpents of Pennsylvania, H. A. Surface (*Penn. Dept. Agr. Mo. Bul. Div. Zool., 4 (1906), No. 4–5, pp. 115–208, pls. 42, figs. 23*).—The snakes known to occur in Pennsylvania are described and notes are given on their distribution, relative abundance, and feeding habits.

The destruction of injurious mollusks, G. Gándara (*Com. Par. Agr. [Mexico], Circ. 53, pp. 15, figs. 6*).—In combating injurious slugs and snails, the author recommends collection by hand and the use of various spraying devices distributing irritating and poisonous substances.

Variation in parthenogenetic insects, V. L. Kellogg (*Science, n. ser., 24 (1906), No. 622, pp. 695–699*).—It is commonly accepted at least by one school of biologists that variation in living organisms is partly the result of the mixing of the different tendencies from the 2 parents. According to this theory organisms produced parthenogenetically should show less variation. A study of this matter in bees and plant lice showed the opposite condition to be true. Drones, which are known to be parthenogenetic in origin, showed a greater variation than worker bees. In a few instances parthenogenetic eggs were obtained from worker bees and the drones produced from these eggs showed a great amount of variation. Similarly the variation observed in plant lice produced parthenogenetically showed as great a range as in the case of mosquitoes and other insects in which amphimixis takes place.

Zoological studies in the sand regions of the Illinois and Mississippi River valleys, C. A. Hart (*Bul. Ill. State Lab. Nat. Hist., 7 (1907), Art. 7, pt. 3, pp. 195–272, pls. 5*).—In the investigations upon which this article is based, particular attention was given to the geographical distribution of important species of insects in the sand-hill regions of the Illinois and Mississippi River valleys. Observations were made on Orthoptera, Hemiptera, Coleoptera, Neuroptera, Lepidoptera, and other orders of insects as well as upon batrachians and reptiles. A brief bibliography of the subject is given.

Report of the economic zoologist, H. A. Surface (*Ann. Rpt. Penn. Dept. Agr., 11 (1905), pp. 129–144*).—The work of the year has consisted in the examination of specimens sent in for determination, the investigation of various outbreaks of injurious insects, giving lectures in various parts of the State, the inspection of nurseries and orchards, and making collections of insects. Lists are given of the licensed nurserymen and tree dealers in Pennsylvania.

Insect notes for 1906, EDITH M. PATCH (*Maine Sta. Bul. 134, pp. 209–228, pls. 4*).—The author presents notes on the present status of brown-tail moth, gypsy moth, potato insects, alder blight, larch case-bearer, apple maggot, codling moth, diamond-back moth, etc. The diamond-back moth is reported as having been unusually injurious in greenhouses.

Notes on some Fijian insects, F. MUIR (*Hawaiian Sugar Planters' Sta., Div. Ent. Bul. 2, pp. 11, pl. 1*).—It was found that in Fiji the common species of sugar cane leaf hopper is held in check by various parasites. About 85 per cent of the eggs are parasitized and the young and adult leaf hoppers are attacked by *Elenchus tenuicornis*. This species was introduced in Hawaii but did not attack the leaf hoppers there. The insect is described and notes are given on its habits. *Pipunculus vitiensis* is also described as a new species.

Some injurious insects, EMMA M. SOCH and F. A. BARTLETT (*Hampton Leaflets, n. ser., 2 (1906), No. 12, pp. 31, figs. 30*).—Brief descriptions are furnished of a number of the more important injurious insects and practical remedies for controlling these pests are suggested.

Horticultural insect enemies, D. L. VAN DINE (*Hawaii. Forester and Agr., 3 (1906), No. 11, pp. 341–350*).—Brief notes are given on the anatomy of insects, the usual methods of controlling them by insecticides, orchard sanitation, natural enemies, and quarantine. A list is presented of the more injurious horticultural insects in Hawaii.

Some of the Coccinellidæ, G. W. DIMMOCK (*Informe An. Estac. Cent. Agron. Cuba, 1, (1904–5), pp. 287–392*).—An elaborate discussion is given of the anatomy, metamorphosis, and life history of the Coccinellidæ known to occur in Cuba. Detailed descriptions are given of species, with notes on their habits and with an analytical table to assist in identifying the species. A bibliography relating to the subject is appended to the article.

Notes on certain cranberry-bog insects, H. J. FRANKLIN (*Ent. News, 18 (1907), No. 1, pp. 17–20*).—A study was made of the insects on cranberry bogs in the region of Cape Cod in the season of 1906. Brief descriptive and economic notes are given of *Cymatophora sulphurea*, *Glœa sericea*, etc.

The important forest insects, G. GRÖNBERG (*Skogsvårdsför. Folkskr., No. 7, pp. 32, figs. 37*).—The author presents a general account of the habits, life history, and means of combating various species of Melolontha, Hylobius, Pissodes, Scolytus, Tomicus, Bombyx, Psilura, etc. Considerable attention is given to methods of fighting the nun moth in large forests.

The Hessian fly, H. A. GOSSARD and J. S. HOUSER (*Ohio Sta. Bul. 177, pp. 39, pl. 1, figs. 3*).—For several years the station has made observations on the habits of the Hessian fly and practical means of combating this pest. The insect is described in its various stages and notes are given on its life history and food plants.

Observations extending over a period of 3 years give little support to the idea of immune varieties of wheat. The strength of the straw, however, is an important factor. Stiff vigorous straw will stand up under infestation with one and sometimes more of the insects. It appears that wheat well fertilized, particularly with phosphatic manures, will produce a heavy strong straw which will resist the attacks of the Hessian fly much better than wheat which has been excessively fertilized with nitrogen.

In combating the Hessian fly with direct remedies, the best results are obtained from burning the stubble. This should be done before the flies have emerged from the stubble or before the first of September. In the southern parts of the State the stubble should be burned by the middle of August. Where burning is not practicable good results will follow fall plowing in which the stubble is turned under to a depth of several inches.

The authors recommend as a general programme for controlling the Hessian fly that seed should be selected from a crop showing large or medium straw with excellent stooling qualities. The ground should be thoroughly cultivated and the seed sown not too late, since the damage can sometimes be overcome more successfully by early sowing than it can be avoided by late sowing.

The locust plague, M. T. PIZARRO (*Com. Par. Agr.* [*Mexico*], *Circ. 52, pp. 11, figs. 11*).—Arsenical sprays have proved quite efficient in controlling injurious locusts in Mexico. Mention is also made of locust fungus, the uses of various mechanical devices, and the benefits derived from the presence of insectivorous birds.

The locust invasion, C. P. LOUNSBURY (*Agr. Jour. Cape Good Hope, 29* (*1906*), *No. 5, pp. 596–600*).—An outline is given of the means by which the local government proposes to aid in the extermination of locusts. The government furnishes men to organize campaigns against the locust and also assists infested districts by furnishing spraying materials.

The control of locusts, F. LAHILLE (*Bol. Min. Agr.* [*Buenos Ayres*], *6* (*1906*), *No. 1–2–3, pp. 69–109, pls. 3, figs. 2*).—The life history and habits of locusts are described with special reference to suitable methods for controlling these insects. Considerable success has been had from the use of a poisoned bait containing sugar and white arsenic. A quite thorough test was made of *Empusa acridii* which was distributed over large areas infested with locusts. Other fungi were also tested with fairly satisfactory results.

The author found that a mite (*Podapolipus bertesci*) renders some assistance in controlling locusts by living as a parasite upon them. This mite is described in all its stages.

The rice grasshopper, J. B. KNIGHT and R. M. DIXON (*Dept. Agr. Bombay Bul. 27, pp. 4, figs. 3*).—*Hieroglyphus furcifer* attacks rice, sugar cane, sorghum, corn, and various cultivated as well as wild grasses. The pest is described in its various stages and notes are given on its natural enemies which assist somewhat in its control. In combating the insect, infested fields should be thoroughly plowed in January and February. Good results are also reported from the use of sweeping nets in catching the young insects.

The San José or Chinese scale, C. L. MARLATT (*U. S. Dept. Agr., Bur. Ent. Bul. 62, pp. 89, pls. 9, figs. 12*).—The Bureau has previously published general accounts of the San José scale in Bulletin 3 (E. S. R., 8, pp. 500, 501) and in Bulletin 12 (E. S. R., 10, pp. 370, 371). The present bulletin is a thorough revision of previous publications on San José scale by the Bureau with additional notes regarding the travels of the author through China and other Asiatic countries and the evidence in favor of considering China as the original home of this scale.

The San José scale in Alabama, F. H. CARDOZA (*Alabama Tuskegee Sta. Bul. 9, pp. 10, pl. 1*).—This bulletin contains practical information for the use of colored farmers in Alabama. It is recommended that badly infested trees be sprayed soon after the wood has matured in the fall and again in the spring before the buds open. The best results were obtained from the use of a lime-sulphur-salt solution made in the proportion 25 : 16 : 10 : 50.

Commercial miscible oils for treatment of the San José scale, P. J. PARROTT, H. E. HODGKISS, and F. A. SIRRINE (*New York State Sta. Bul. 281, pp. 261–270*).—Proprietary miscible oils were tested in spraying 1,368 trees in solutions containing 1 part oil to from 10 to 25 parts of water. The weaker solutions failed to give uniform results, although the fruit was somewhat spotted by the treatment. When used at the rate of 1 part of oil to 10 or 15 parts of water the scale insects were more completely destroyed, but the mixtures were not

quite as effective as lime-sulphur wash. The authors recommend that miscible oils should not be used in weaker solutions than 1 : 10 or 15 parts of water.

Miscible oils have the advantage of being convenient to prepare and apply and are suitable for use in small orchards and individual trees in gardens. They are, however, altogether too expensive for use on a commercial scale. In some instances, the miscible oils give such unsatisfactory results that the fruit grower must make additional summer and fall applications in order to eradicate the scale.

Miscible oil sprays, F. H. HALL (*New York State Sta. Bul. 281, pop. ed., pp. 7, fig. 1*).—A brief summary of Bulletin 281 of this station noted above.

Patent washes for San José scale, C. E. CRAIG (*Va. Crop Pest Com. Circ. 2, n. ser., pp. 11*).—A number of proprietary lime-sulphur mixtures and miscible oils were tested in comparison with lime-sulphur wash. The last-named insecticide proved to be the cheapest and most effective for orchard work. Some of the washes are convenient for use in a small home garden, but are too expensive as compared with lime-sulphur wash for general orchard work.

Lime-sulphur wash studies, 1904–1906, J. L. PHILLIPS (*Va. Crop Pest Com. Circ. 1, n. ser., pp. 23*).—A chemical study was made of various lime-sulphur mixtures prepared in different ways or from different formulas.

The author concludes as a result of this study that practically all of the sulphur is dissolved by vigorous cooking for 40 minutes and that the yellow color of the wash is due to the mechanical mixture of the liquid and sediment. If cooking be prolonged a somewhat larger per cent of lime combines with the sulphur, but this is of little practical importance. If the wash is cooked in concentrated form some sulphur is lost by volatilization. The presence of magnesia or other impurities in the lime may also cause a considerable loss of sulphur.

The codling moth, C. BÖRNER (*Deut. Landw. Presse, 34 (1907), No. 3, pp. 17, 18, figs. 6*).—In Germany the codling moth goes through only one generation per year. A number of natural enemies of the pest are known, but spraying and banding of trees are considered necessary.

A new cabbage-eating larva, G. H. CARPENTER (*Jour. Econ. Biol., 1 (1906), No. 4, pp. 152–156, pl. 1, fig. 1*).—The common beetle *Psylliodes chrysocephala* was observed boring in young cabbage plants in the larval condition. The infested plants were destroyed, and in this way much injury was done, since a considerable percentage of the plants was attacked. The habit of feeding upon cabbage plants appears to be newly acquired.

A new enemy of the raspberry, P. MARCHAL and J. VERCIER (*Bul. Mens. Off. Renseig. Agr. [Paris], 5 (1906), No. 12, pp. 1494–1499, figs. 4*).—The authors report serious injury to raspberries from the attacks of *Agrilus chrysoderes rubicola*. Infested canes show fusiform swellings resembling galls at various points. The larvæ of the beetles live in these swellings. In combating this pest it is recommended that all infested canes should be cut and destroyed in winter and that the raspberry patch should again be examined for the presence of the pest in May.

The life history of a cochlidian moth (Adoneta bicaudata), H. G. DYAR (*Biological Studies by the Pupils of William Thompson Sedgwick. Boston: June, 1906, pp. 11–19, pl. 1*).—The author has given considerable attention to the life history of species of this group and describes *Adoneta bicaudata* in its various stages, together with notes on its peculiar life history.

A winter spraying of fruit trees, W. E. COLLINGE (*Univ. Birmingham, Dept. Econ. Zool. Circ. 2, pp. 2*).—In experiments in controlling the plant lice on apple

trees and also a number of other related insect pests good results were had from the use of a mixture containing 2 lbs. of caustic soda, 0.5 lbs. soft soap, and 5 pts. of kerosene in 10 gal. of water.

Tobacco as an insecticide, J. R. INDA (*Com. Par. Agr. [Mexico], Circ. 44, pp. 4, fig. 1*).—The general insecticide value of tobacco is discussed, with mention of specific instances in which it is particularly adapted for use.

An apparatus for testing the value of fumigating agents, A. I. KENDALL (*Biological Studies by the Pupils of William Thompson Sedgwick. Boston: June, 1906, pp. 313–320, figs. 5*).—A detailed description is given of an apparatus for testing the efficiency of various fumigating substances in the destruction of mosquitoes and other household insects. The author reaches the conclusion that the results obtained from a given amount of fumigating substances per unit of space in a small box may be safely applied to large rooms, since in his experience the effect of fumigating substances is more pronounced in large spaces than in small laboratory apparatus. It also became apparent during the author's investigation that the more rapidly the fumigating substances were volatilized or set free the more efficient their action.

White ants, J. DESNEUX (*Informe An. Estac. Cent. Agron. Cuba, 1 (1904–5), pp. 393–407, pl. 1, figs. 9*).—The different forms of individuals observed in colonies of white ants are described and notes are given on the nest building of these insects.

On the life history of Stomoxys calcitrans, R. NEWSTEAD (*Jour. Econ. Biol., 1 (1906), No. 4, pp. 157–166, pl. 1*).—While the favorite habitat of this fly is found in barnyards and stables, the author failed to find a larval condition in the manure in such locations as was naturally to be expected. After considerable search, however, the larvæ were found in decaying grass cuttings which had been piled up around cucumber beds. The insect is described in its various stages and brief notes are given on its habits. The author estimates the time required for a complete cycle from one generation to another at from 42 to 78 days.

Some Scottish Ixodidæ (ticks), W. EVANS (*Ann. Scot. Nat. Hist., 1907, No. 61, pp. 34–37*).—Brief mention is made of the appearance and habits of *Ixodes ricinus*, *I. hexagonus*, *I. putus*, etc.

Improvement of honeybees, F. BENTON (*Ann. Rpt. Penn. Dept. Agr., 11 (1905), pp. 705–712*).—The author describes briefly the chief characteristics of the common races of bees with particular reference to their relative merits and demerits. Advice is also given regarding the selection of queens for breeding purposes.

Swarming of bees, H. VON BUTTEL-REEPEN (*Ztschr. Wiss. Insektenbiol., 2 (1906), No. 11, pp. 359–361*).—A controversial article dealing with the cause of swarming in bees.

Foul brood and other diseases of bees, N. E. FRANCE (*Ann. Rpt. Penn. Dept. Agr., 11 (1905), pp. 691–694, pls. 2*).—This disease is most frequently transmitted to uninfested localities by selling infected bees, combs or bee supplies, by shipping queens from infected apiaries or through the agency of robber bees. The symptoms of the disease are briefly described and a suitable treatment is outlined.

The laws in force against injurious insects and foul brood in the United States, L. O. HOWARD and A. F. BURGESS (*U. S. Dept. Agr., Bur. Ent. Bul. 61, pp. 222*).—This bulletin contains copies of the laws in force in various States for the control of injurious insects and foul brood. The laws are arranged alphabetically according to States and contain references in relation to plant

diseases as well as injurious insects. A brief summary was also given of the work accomplished by the American Association of Horticultural Inspectors at its various meetings.

FOODS—HUMAN NUTRITION.

The elements of the science of nutrition, G. LUSK (*Philadelphia and London: W. B. Saunders Co., 1906, pp. 326, pl. 1, figs. 11*).—It has been the author's purpose to review the scientific data upon which rests the knowledge of nutrition in both health and disease with a view to more fully meeting the interest in the subject which at the present time is manifested by students of dietetics, physicians, and others.

Clear and concise summaries are given of the theories of nutrition. Such subjects as the regulation of temperature, the influence of proteid food, the specific dynamic action of the foodstuffs, the influence of the ingestion of fat and carbohydrate, the influence of mechanical work on metabolism, a normal diet, the food requirement during the period of growth, purin metabolism, general theories of metabolism, and metabolism in different diseases are among the topics discussed.

Throughout the volume citations are made from the literature of the subjects treated and the volume as a whole presents a concise and valuable summary of information, much of which has not been readily accessible to the student. The volume also gives a reasonably complete summary of the views which are at present held regarding nutrition in health and disease and full indexes add to its value.

Human foods, J. ALQUIER (*Rev. Soc. Sci. Hyg. Aliment., 3 (1906), No. 1, pt. 1, pp. 68, figs. 4; pt. 2, pp. 6+tables XIV*).—The author has prepared an extended compilation of analyses of animal and vegetable foods. The recorded data show maximum, minimum, and average values and the proportions of total and digestible nutrients. Tables are also given showing the amount of various food materials which are equivalent to 100 lbs. of a given material taken as a standard. In the introductory section, methods of cutting meat and other questions are discussed and the system of tabulating results is explained.

Human food, J. ALQUIER (*Les Aliments de l'Homme. Paris: Masson & Co., 1906, pts. 1, pp. 68, figs. 4; 2, pp. 6+tables XIV*).—A reprint of the above in book form.

Food analyses, V, J. T. WILLARD (*Bul. Kans. Bd. Health, 2 (1906), No. 12, pp. 300–307*).—The analyses reported include milk, ice cream, a substance sold for use in thickening ice cream, butter, water, and ice.

Of the 34 samples of ice cream examined only one was found to contain borax. Formaldehyde was not found. Four of the samples contained starch. The butter-fat content varied from 2.7 to 18.4 per cent, being 9.66 per cent on an average. If 12 per cent fat be adopted for a standard, as suggested by the author, over half of the samples would fall below the standard.

"It would seem that the manufacturer furnishing a high grade of ice cream, which is really nutritious and contains a good per cent of butter-fat, should be protected against the vendors who put upon the market an article of very inferior quality, containing no more butter-fat than a good quality of milk. At any rate the customer should pay less for the cheaper cream.

"There are quite a number of products on the market which are used to thicken cream, so that from a very low grade of cream a product may be obtained which somewhat resembles that from a high grade of cream. These

substances, while they may not be injurious, are simply thickening material, and serve to cheapen the product."

The substance sold to thicken ice cream was a white powder with a slightly sweet taste and used in the proportion of an ounce to 10 gallons of ice cream. It consisted essentially of gum tragacanth, which has the property of swelling to a large bulk when mixed with water. The powder contained 1.77 per cent ash, largely in the form of lime.

Bleaching of flour, E. F. LADD and R. E. STALLINGS (*North Dakota Sta. Bul. 72, pp. 219–235, fig. 1*). Samples of flour bleached under known conditions were examined and compared with unbleached flours, the bleaching being accomplished by the ordinary commercial process employing oxids of nitrogen.

In testing for the presence of oxids of nitrogen a weighed amount of flour or bread was placed in a flask of distilled water and shaken at intervals for 30 minutes. After filtering, a drop of concentrated hydrochloric acid, 1 cc. of sulphanilic acid, and 1 cc. of naphthylamin hydrochlorid were added, the mixture shaken, covered, and allowed to stand for 30 minutes. A known amount of a standard solution of sodium nitrate was treated in the same manner and the solutions compared with the standard in the colorimeter. In all cases it was found that the nitrous oxids remained in the flour after bleaching and the oxid or its salts were also found in bread baked from bleached flour. Baking tests showed that bleached flour gave smaller loaves than unbleached flour. The quality of the wheat gluten was injured by bleaching.

In general, the authors' results were regarded as unfavorable to bleaching. The principal conclusions were in effect as follows:

Bleaching is not an improved milling process but is the introduction of chemical agents for the purpose of treating the flour which is analogous to the bleaching of fruit and other food products. There is employed in the process of bleaching a chemical agent which is physiologically quite active, namely, nitrous oxid.

Bleaching permits of using low-grade flours in place of patents. Low-grade flours produced from well-cleaned wheat can be successfully bleached to resemble high grades or patents.

"The processes for bleaching have been devised for bleaching and 'improving' the color of inferior flours. The manufacturers of these processes openly claim that they (the millers) can increase the percentage amount of patent produced. From our tests it would seem that this could be done without the purchaser becoming any the wiser because the clear grade of flour was susceptible of being 'improved' as well as the patents. . . .

"The claim is made that nitrous acid will form in flour from the air. Our experiments do not indicate this to be the case."

Indian corn as food for man, L. H. MERRILL (*Maine Sta. Bul. 131, pp. 133–145*).—The digestibility of corn meal prepared in different ways and of hominy was studied. In some cases the corn products were eaten with sugar, milk, and sometimes butter, and in others the diet was more varied, though the corn product was its principal constituent. Wheat bread was also studied for purposes of comparison. In every case the digestion experiments were made with healthy subjects. The following table summarizes the results obtained for the total diet and calculated for the corn products alone:

Coefficients of digestibility of a ration containing corn products and corn products alone.

Kind of food.	Total diet.				Corn products.			
	Total protein.	Protein corrected for metabolic products.	Carbohydrates.	Energy.	Total protein.	Protein corrected for metabolic products.	Carbohydrates.	Energy.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Hominy in simple diet	83.6	89.2	99.0	96.4	74.5	84.3	98.2	94.4
Hominy in mixed diet	88.9	93.6	98.8	96.3				
Hasty pudding in simple diet	82.3	89.2	99.0	95.9	73.2	83.9	98.3	93.1
Hasty pudding in mixed diet	89.0	94.0	98.9	96.9				
Johnny-cake in simple diet	89.6	94.9	98.7	93.8	86.3	93.2	98.9	93.5
Johnny-cake in mixed diet	90.1	94.8	99.3	93.9				
Brown bread in simple diet	87.4	94.7	98.7	93.5	83.0	92.8	98.6	93.4
Brown bread in mixed diet	89.5	95.5	99.4	92.9				
Hoe-cake in simple diet	87.0	93.9	98.7	93.7	77.1	88.9	98.6	93.8
Hoe-cake with sirup	84.4	92.6	99.2	95.5	78.8	90.0	98.7	94.0
Hoe-cake in mixed diet	90.0	94.6	98.8	92.6				
White bread in simple diet	89.2	94.0	98.9	91.0	85.6	89.8	98.9	94.0
White bread in mixed diet	92.6	96.1	99.0	98.2				

Considering the diet as a whole, the author notes that, "in every case but one, the protein of the mixed diet was more completely digested than that of the simple diet. The low digestibility of a simple diet has been often noted in previous experiments.

"With a simple diet the protein of the johnny-cake and the brown bread seems to have been slightly more digestible than that of the white bread. With the mixed diet, the white bread shows a digestibility distinctly greater than that of the corn breads.

"The use of sirup with the hoe-cake to a slight degree depressed the digestibility of the protein. This is in accordance with other experiments in which the digestibility of the protein apparently varied with the ratio existing between the protein and the other nutrients."

As pointed out by the author, the calculated values for the digestibility of the corn products alone indicate that they "are either considerably less digestible than the other foods with which they were eaten, or they themselves become more digestible when eaten with other foods. Similar results obtained with other experiments in which certain foods were eaten both singly and with a mixed diet indicate that the second conclusion is the correct one."

The corn and wheat breads used in the experiments were analyzed.

A dietary study of laborers and clerks in Paris, L. LANDOUZY and H. and M. LABBÉ (*Enquête sur l'Alimentation d'Une Centaine d'Ouvriers et d'Employés Parisiens. Paris: Masson & Co., 1906, pp. 72; rev. in Rev. Gén. Sci., 17 (1906), No. 24, p. 1083*).—Data were collected regarding the character of the food consumed by laborers and clerks in Paris, the proportion of income expended for different foods, and related topics.

According to the authors, the diet was deficient and the expenditure for condiments and other materials of low food value was high. Suggestions are made for securing adequate rations for the same expenditures.

A new method of testing the functions of the digestive apparatus, M. EINHORN (*Med. Rec. [N. Y.], 69 (1906), No. 6, pp. 205–209, figs. 3*).—The author attached small portions of different foods to porcelain beads, either by drawing them through the aperture in the bead or by tying the food to the beads. By using different colored beads it was possible to identify the materials after they had passed through the digestive tract.

In some of the tests the beads with the food material attached were inclosed in gauze so that the food substances could not come in direct contact with the walls of the digestive tract. In tests designed to study the effects of gastric digestion beads were attached to a silk thread and were withdrawn from the stomach after a suitable interval.

Experiments with healthy persons showed, according to the author, that both catgut and fish bones were digested in the stomach, whereas boiled or raw meat (beef), raw chicken skin, and both raw and boiled potatoes do not dissolve altogether in this organ. Fish bone was selected for these experiments as its solution in the digestive tract is positive indication of the presence of gastric juice. Catgut was used for the same purpose but is not as satisfactory.

In the case of meat a swelling and lessening of the fibers was noted in the stomach. Raw muscle fiber and chicken skin disappeared in the intestines. Tendons, however, remained undigested. Raw potatoes varied, sometimes digesting entirely and sometimes passing through the body unchanged. Boiled potato, generally speaking, was apparently digested in the bowel, while the skin of potato, either raw or boiled, was always excreted unchanged. Wax, paraffin, and fats with a high melting point, such as stearic acid, etc., were not absorbed in the intestine, but suet and mutton fat, which melt at 50° C., were digested in the bowel. Other experiments made with mutton fat showed that it remained unchanged in the stomach.

To determine whether the disappearance of mutton fat in the intestines was a chemical or mechanical process produced by the epithelium of the intestine, beads containing mutton fat and surrounded by gauze were swallowed. All the mutton fat in the beads disappeared which, according to the author, shows that chemical processes play the principal part in the absorption of mutton fat. Thymus gland and potato were taken in a similar way and it appeared that the gauze envelope did not hinder digestion.

The results obtained with normal subjects, in the author's opinion, show that the method can be employed for testing digestion in disease and a number of experiments made under pathological conditions are reported.

The acceleration of the action of the pancreatic juice by the salts of calcium, E. Delezenne (*Brit. Med. Jour., 1906, No. 2399, pp. 1785, 1786*).—As pointed out by the author in a paper presented at the Toronto meeting of the British Medical Association, the pancreatic juice obtained in its inactive form from the pancreatic duct either by means of a permanent fistula or by the aid of intravenous injections of secretin acquires a very powerful proteolytic activity when mixed with a suitable quantity of a soluble calcium salt and incubated for several hours.

"The action of the salts of lime must be considered a specific one. The salts of other metals of the same series (barium, strontium, magnesium) have little or no effect. Any slow action they may appear to possess may be explained by the presence in them, or in the pancreatic juice itself, of traces of soluble calcium salts."

Chemical processes in the animal body, R. O. Herzog (*Chemisches Geschehen im Organismus. Heidelberg: Carl Rössler, 1905, pp. 62*).—The possibilities are discussed of applying to the important ferment reactions of the living body the theories of chemical equilibrium and velocity of reaction. Although the results as yet obtained are not altogether satisfactory, the author believes that a mathematical treatment of the problem is possible. In a special case, dog pepsin, a formula is proposed for the rate of secretion of the enzym.

Chemical studies on growth, L. B. Mendel (*Brit. Med. Jour., 1906, No. 2399, pp. 1787, 1788*).—A paper was presented at the meeting of the British Medical Association at Toronto, 1906, which summarized the investigations of the author and his coworkers which have to do with the composition and the chemical changes which are characteristic of developing organisms and the equipment of such organisms for utilizing the nutritive materials presented to them.

The investigations of hens' and ducks' eggs after varying periods of incubation have furnished new evidence regarding the synthesis of purins in embryonic forms. The fresh egg is practically free from purins. The quantities of purins gradually increase during incubation until the young are fully hatched. The specific purin compounds which especially are synthesized as a part of the newly-formed nucleoproteid constituents are guanin and adenin, traces only of hypoxanthin being obtained. . . . We have found that the liver tissue of the embryo (pig) has apparently not yet acquired the capacity of destroying uric acid to any considerable extent, if at all—in striking contrast with comparable material from adult animals. . . . One may conclude that the embryonic organs, such as the liver, are early equipped for the preliminary reactions in purin synthesis and degradation, in harmony with the extreme richness of the embryonic liver morphologically in nuclear materials.

"Nucleic acids are characterized by the presence of pentose groups, as well as purin complexes. The egg itself is practically free from furfurol-yielding compounds. With the progress of incubation pentose groups are synthesized, as might be expected from the characteristic development of nuclear materials."

The development of specific enzyms, the glycogen content of the embryo, and lipoids are also considered. In general, "analyses of the water-free and fat-free tissues of animals fed on diets of widely different character indicate the tendency of the tissues to maintain a constant chemical character."

Metabolism experiments with organic and inorganic phosphorus, J. A. LeClerc and F. C. Cook (*Jour. Biol. Chem., 2 (1906), No. 3, pp. 203–216*).—Studies were made with 2 rabbits and a dog in which inorganic phosphorus in the form of disodium phosphate and such organic phosphorus compounds as occur in wheat bran and in egg yolk were compared. In the authors' opinion the experiments point to the following conclusions:

The amount of nitrogen retained is generally lowered by the addition of inorganic phosphorus when fed with a normal food. The nitrogen balance is not necessarily negative.

In the case of food supplying little phosphorus, the addition of inorganic phosphorus decreases the digestibility of the nitrogen and the nitrogen and phosphorus balances are usually negative.

Organic phosphorus favors nitrogen metabolism and increases the nitrogen and phosphorus retention, especially in the case of the food supplying little phosphorus. Organic phosphorus, therefore, is more favorable to nitrogen and phosphorus retention than is inorganic phosphorus. The phosphorus of wheat bran appears to be a most valuable food constituent.

The nitrogen of bran was poorly assimilated. The loss of nitrogen during the periods in which bran was fed agree with earlier work, showing the low digestibility of bran nitrogen and corroborate the results obtained regarding the absorption of bran phosphorus.

The nitrogen and phosphorus balances do not run parallel in all cases; the general tendency is in that direction.

In no case was there any retention of the added phosphorus, whether fed in the organic or in the inorganic form, when given with a food containing a normal amount of phosphorus.

In no case was organic phosphorus found in the urine even when an extra amount of organic phosphorus was ingested.

The greater part of the phosphorus, whether organic or inorganic, was excreted through the kidneys.

Nitrogenous metabolism as affected by diet and by alkaline diuretics, H. D. Haskins (*Jour. Biol. Chem., 2 (1906), No. 3, pp. 217–229*).—The rations selected included a low diet made up of vegetable foods with a little milk and cream and considerable butter, a "standard" diet furnishing about 15 gm. of nitrogen and made up of vegetable foods and milk and eggs in considerable quantity, a "heavy" diet similar in character to the "standard" diet and furnishing 23 gm. of nitrogen, and a meat diet which contained about 390 gm. of very lean chopped beefsteak beside milk, butter, bread, and dates. One of the 3 men who served as subjects also followed a purin-free diet for several days. With this subject no account was kept of the fuel value of this ration, but the author considers that his diets were deficient in energy. With the other 2 subjects the fuel value of the diet was calculated to be about 3,000 calories.

Neither sodium citrate nor sodium bicarbonate, when added to the ration, influenced the total nitrogen excretion. They also failed to cause diuresis. "The sudden change to a low diet caused in each experiment an initial fall in body weight, but this was quickly recovered from in both cases where the fuel value was sufficient. The weight of these 2 men increased slightly on the heavier diet." The subject whose diet was deficient in energy lost steadily throughout the experiment until the meat diet was begun.

The recorded data "show that nitrogenous equilibrium is quickly secured if the nitrogen intake does not drop below 5 gm., as others have also observed. The nitrogen excretion remains fairly constant at 5 to 6 gm. even when the food nitrogen drops below that amount. . . . On the standard and on the meat diet an approximate nitrogenous equilibrium was readily obtained; on the heavy diet, however, equilibrium was not secured, 16 gm. being the maximum nitrogen excretion."

In these experiments the alkalies studied decreased the ammonia excretions very markedly under all conditions of diet, the ammonia being usually reduced to one-third of the amount normally excreted. At the same time the urea excretion was increased, the amount corresponding roughly to the decrease in the ammonia excretion.

The metabolism of creatin and creatinin, O. Folin (*Brit. Med. Jour., 1906, No. 2399, p. 1787*).—The conclusions drawn from the data presented at the meeting of the British Medical Association at Toronto, 1906, follow:

"There is no experimental evidence showing that creatin is the immediate precursor of the creatinin appearing in the urine.

"Biologically there seems to be a fundamental difference between creatinin and creatin.

"In the author's opinion it is not yet clear whether creatin is a waste product or a food."

Carbohydrate metabolism, F. W. Pavy (*London: J. & A. Churchill; Philadelphia: P. Blakiston's Son & Co., 1906, pp. XII+138 pls. 8*).—This volume contains a course of lectures given at the University of London in 1905 and is largely made up of the author's experiments and his deductions and conclusions from them. The subject is discussed from a physiological and a pathological standpoint.

Some properties of the albumens present in duck egg white, A. Panormow (*Zhur. Russ. Fiz. Khim. Obshch., 37 (1905), pp. 923–931; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 11, pp. 665, 666*).—Two albumens,

anatin and anatinin, were identified in the white of duck egg and, according to the author, these are the only albumens present, the relative proportion being one part of anatin to two of anatinin.

Concerning dried fruit, R. Stecher (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 11, pp. 645–652*).—Analyses of a large number of samples of dried plums, prunes, pears, and apples are reported, the studies being undertaken with special reference to composition and the market and shipping qualities.

The acidity of fruits, W. F. Sutherst (*Chem. News, 92 (1905), No. 2393, p. 163; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 11, p. 671*).—The acid flavor of fruits is usually more noticeable after cooking and, according to the author, this is due to the fact that cooked fruit (gooseberries, currants, plums, etc.) usually contains the skin, which is commonly rejected if the fruit is eaten raw. The skin is more acid than the pulp. As was shown by analyses of gooseberries, the skin contained 2.66 per cent acid, expressed as tartaric acid, and the pulp 1.80 per cent.

To determine whether acid is formed when fruit is cooked, a mixture of nearly ripe gooseberries and water was boiled for about 30 minutes and then titrated with sodium-hydroxid solution. The boiled portion contained less acid than the raw, "due, no doubt, to the volatility of some of the acids."

As regards the effect of cooking on the kind and amount of sugar present, uncooked gooseberries were found to contain 1.16 per cent cane sugar and 5.84 per cent invert sugar. After boiling, no cane sugar was found, while the invert sugar amounted to 6.91 per cent. This indicates that "all the sugar undergoes inversion during cooking, the acid present bringing this about as in the usual process of hydrolysis."

Canned artichokes, P. Carles (*Rev. Internat. Falsif., 18 (1905), pp. 80, 81; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 11, p. 673*).—Artichoke buttons are the portion used for canning. They contain a large amount of oxydase which acts upon the tannin or other oxidizable material present and causes a brown discoloration. Short treatment with a cold 2 to 10 per cent sulphurous-acid solution before canning is recommended by the author to prevent discoloration. In addition to sulphurous acid citric acid and tartaric acid are used. After an hour in the acid the artichoke buttons are washed, seasoned, and processed.

Chuño, a frozen potato product from Bolivia, E. Parow (*Ztschr. Spiritusindus., 28 (1905), p. 405; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 11, p. 672*).—The potato product described is made by crushing frozen potatoes and removing the greater part of the moisture present by further exposure to cold and to the air. The resulting hard mass contains about 15 per cent water and may be kept for a considerable time. As shown by analyses, the material resembled German dried potatoes quite closely in composition.

Concerning spices, H. Sprinkmeyer and A. Fürstenberg (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 11, pp. 652–658*).—The authors determined the water and ash constituents in a large number of samples of pepper, cinnamon, allspice, and cloves. The fact is recognized that in certain spices, for instance, pepper, there are great variations in the ash content, while in others, as allspice and cloves, the variations are small, yet the authors do not believe that such data are sufficient for judging of the quality of the goods.

Digestion experiments with chestnuts, L. H. Merrill (*Maine Sta. Bul. 131, pp. 146–148*).—Two experiments are reported in which the digestibility of chestnut flour cooked as mush was studied with healthy men. Some bread, potatoes, and milk were eaten with the chestnut flour. The calculated digestibility of chestnut flour alone with one subject was, protein 41.6 per cent, fat 53.5 per cent,

carbohydrates 97.1 per cent, and the available energy 86.4 per cent. With the second subject, the coefficients of digestibility were, protein 69.5 per cent, fat 71.9 per cent, and carbohydrates 98.6 per cent, while the available energy was 92.2 per cent.

Marula nuts (*Transvaal Agr. Jour., 5 (1906), No. 17, pp. 136, 137*).—An analysis of the kernel of the fruit of the marula tree (*Sclerocarya caffra*) is reported. The marula nut contains about 50 per cent of oil which it is believed might be used as a substitute for olive oil in cloth manufacture. The iodin value of the oil was found to be 74. Other constants were also determined.

ANIMAL PRODUCTION.

Foods and fodder plants, W. R. DUNSTAN (*Rpt. Imp. Inst. So. Kensington, 1905, pp. 18–20*).—Brief statements are made regarding the extent and character of the analytical and other work pertaining to foods and plants. Studies of Cape Colony oats were undertaken as it has been alleged that they are unsuitable as forage and produce a peculiar bone disease in animals fed with them. From a study of 4 typical samples the conclusion was reached that the oats were deficient in mineral constituents, which are important bone-forming materials, "and it is probably to this deficiency that the ill effects observed in horses fed with these oats are due."

In a study of the occurrence of hydrocyanic acid in feeding stuffs, large quantities were found in beans (*Phaseolus lunatus*) ground up and moistened with water. A number of cases of cattle poisoning have been reported which were due to feeding such Java beans.

Commercial feeding stuffs, T. I. MAIRS (*Pennsylvania Sta. Bul. 81, pp. 15*).—The characteristics of different commercial feeding stuffs are discussed and the methods of manufacture and preparation of a number of commercial by-products are briefly spoken of.

As regards alfalfa meal, a feeding stuff which has been recently placed on the market, the author states: "It is merely ground alfalfa hay. It is recommended by the makers as a substitute for bran. There seems to be no reason why it should be any more digestible than the hay from which it is made. It may possibly be less digestible than average hay on account of there being so great a temptation to grind the poorer grades of hay. It forms a part of many of the so-called dairy and stock feeds." Some of these commercial feeding stuffs contain molasses in addition to alfalfa meal.

As regards grinding in general, the author notes that it "adds comparatively little to the digestibility of the feed for healthy animals. It may even tend to detract from it, as the ground feed is more apt to be swallowed without chewing and mixing with the saliva. It is an expensive process, particularly where it is necessary to haul the grain some distance to the mill and pay from one-eighth to one-sixth toll. With corn at fifty cents per bushel one-eighth toll amounts to twelve and three-quarter cents per hundredweight, or $2.55 per ton. . . . Some millers charge a flat rate of about $2 per ton, varying with the kind of grain to be ground. This is usually more equitable and more economical. To this cost must be added the expense of hauling the grain to the mill and returning the feed. Where much grinding is to be done, it pays the farmer to own his mill."

A summary of data on the amount of total digestible nutrients furnished by the different feeding stuffs shows that under local conditions "corn-and-cob meal, buckwheat middlings, wheat middlings, and hominy chop are the cheapest feeds, followed closely by malt sprouts, dried distillers' grains, corn meal, and

gluten feed. The relative prices may vary somewhat in different localities, but in general it is probably safe to say that these will be the cheapest feeds this season. The most expensive feed . . . [included in the comparison] is alfalfa meal, the next most expensive linseed meal."

The chemical and physiological properties of cell walls, A. FÜRSTENBERG, R. MURDFIELD, and J. KÖNIG (*Landw. Vers. Stat., 65 (1906), No. 1–2, pp. 55–110*).—The chemical and physiological experiments reported led to a number of conclusions, among which are the following:

The glycerin-sulphuric acid method was found to be satisfactory even for cellular tissue rich in pentosans. When the crude fiber of feces was treated with glycerin-sulphuric acid, the hemicelluloses and the pentosans were very thoroughly dissolved, so that this method seems the preferable one even for materials rich in lignin. The difficultly soluble portion of cell membrane designated crude fiber in food and feeding stuff analyses consists of 3 groups of different properties and with different carbon content, namely, (1) a cellulose group with 44.44 to 46 per cent carbon, which is soluble in copper oxid and ammonia; (2) the portion of the lignin group which can be oxidized with hydrogen peroxid and ammonia and has a carbon content of 55 to 60 per cent; and (3) "kutin," which has even a higher carbon content and is not oxidized by either of the reagents mentioned. The cellulose group is quantitatively soluble in copper oxid and ammonia only after the removal of the portion which can be oxidized. The crude fiber which remains after the removal of lignin and kutin and which is soluble in copper-oxid ammonia and gives a violet color with chlorid of zinc and iodin and a blue color with sulphuric acid and iodin, does not always possess the composition of true cellulose, but sometimes shows a higher carbon content owing to the addition of methyl or methoxyl groups. Such cellulose has been identified in rye and wheat bran and in very small quantity in barley bran.

Methoxyl, ethoxyl, or acetyl groups are present in larger proportion in lignin, but are entirely absent in kutin. Lignin is evidently not a simple body, but consists of a number of carbon radicals united to cellulose.

The proportion of kutin in crude fiber is by no means small. According to the analyses which have been made it ranges from 0.64 per cent in pea bran to 13.67 per cent in wheat bran, and from 0.76 per cent in pea bran feces to 19.05 per cent in wheat bran feces.

As is well known, the percentage content of crude fiber in plants increases with age. On the other hand, the lignin content increases more rapidly than the cellulose. No fixed relation is apparent between kutin content and plant growth.

The digestibility of the cell membrane of coarse fodders by sheep is inversely proportional to the lignin and kutin content. Cellulose is the most thoroughly digested of the crude fiber constituents. Lignin is very resistant to the digestive juices of herbivora and is only utilized to a very small extent. If kutin is utilized at all it is only in very small quantity and when it occurs in very young plants. With pigs the digestibility of the crude fiber of bran, with the exception of pea bran, is very slight, as is also the case with rabbits. That portion of the crude fiber which contains the lower percentage of carbon has a higher digestibility than the portion with the high carbon content. These animals also digest kutin very little if at all.

Since the digestibility of crude fiber in general is inversely proportional to the lignin and kutin content, it seems probable that the lignin and kutin, or the latter alone, surrounds the cellulose or is deposited in it in such a way that the action of the digestive juices is hindered. These things being so, it is

very desirable to determine the proportion of lignin and kutin in feeding stuffs in order that an estimate of their true value may be made.

The use of locusts as food, H. INGLE (*Transvaal Agr. Jour., 5 (1906), No. 17, pp. 111–116*).—Analyses of sun-dried locusts which have been killed by half-hour immersion in boiling water showed that they contained on an average 10.31 per cent water, 57.96 per cent protein, 11.05 per cent fat, 11.26 per cent crude fiber, and 5.31 per cent ash. The author states that there was also a small quantity of some sugar-like compound, the nature and amount of which was not determined and which was possibly derived from the food present in the insects' stomachs. The silica, lime, potash, and phosphoric acid content of the locusts were also determined, the average phosphoric acid content being 1.48 per cent.

As pointed out, the dried locusts resemble some of the commercial feeding stuffs of animal origin and their use is recommended for farm animals. As shown by the results of practical experience, they have been particularly useful as a poultry feed and a pig feed. Many farmers believe that locust meal produces large yolks of a richer color than usual and that they do not affect the flavor of eggs. Furthermore, locusts are "well worth collecting and killing for manurial purposes. Their value as a fertilizer is very great, because of their richness in nitrogen and phosphoric acid."

Farm animals, E. V. WILCOX (*New York: Doubleday, Page & Co., 1906, pp. VI + 357, pls. 63*).—The characteristics of different breeds, the principal problems which must be met in the feeding and care of farm animals, the importance of different feeding stuffs, animal diseases and their treatment, and other questions regarding the production, feeding, care, and management of farm animals are considered in this volume, which constitutes an important summary of available data. Notable features of the volume are the extensive use which has been made of the results obtained by experiment station investigators, and the scope and accuracy of the data presented. Special chapters are devoted to the horse, mule, beef cattle, dairy cows, pigs, sheep, goats, and poultry.

Steer feeding, J. H. SKINNER and W. A. COCHEL (*Indiana Sta. Bul. 115, pp. 311–337, figs. 6*).—Using 3 lots of 11 steers each the efficiency of various combinations of corn and other feeds, such as corn stover, oat straw, and clover hay, commonly available on Indiana farms, was studied.

On ear corn and clover hay, the average daily gain per steer in the 180 days of the test was 2.08 lbs. On ear corn, shredded corn stover, oat straw, and a little linseed meal, the gain was 1.78 lbs. per head per day, and on a similar ration without linseed meal the gain was 1.30 lbs., the cost of a pound of gain in the 3 cases being 6.59, 7.79, and 8.46 cts. The smallest grain ration, 17.59 lbs. was fed to the lot receiving ear corn, shredded stover, and oat straw, and the largest grain ration, 20.45 lbs., to the lot given the linseed meal. The last-mentioned lot received the smallest amount of coarse fodder, 7.02 lbs., and the lot fed clover hay the largest amount, 8.32 lbs.

Pigs sufficient in number to gather the undigested feed followed the steers and produced 2.10 lbs. of pork per bushel of corn on the clover-hay ration, 1.80 lbs. on the ration containing linseed meal, and 1.78 lbs. on the ear corn, shredded stover, and oat straw ration.

Some of the conclusions drawn were in effect as follows: The ear corn, shredded stover, and oat straw ration was neither efficient, economical, nor profitable. The addition of a nitrogenous feeding stuff, either in the form of a concentrated feed or coarse fodder, added to the efficiency of the ration and the profit of the feeder. The concentrated feeds tested, namely, clover hay and lin-

seed meal, both proved satisfactory. The steers fed the ration containing linseed meal were as well finished as those receiveing the clover-hay ration, although they made smaller gains.

The feeding of beef cattle, T. BUTLER (*Bul. N. C. Dept. Agr., 27 (1906), No. 5, pp. 27, figs. 6*).—In the author's opinion the feeding of beef cattle in North Carolina should be increased and may be profitably practiced to insure the utilization of local-grown feeding stuffs and consequent improvement of soils.

The available concentrated feeds, he points out, are cotton seed and cotton-seed meal and the coarse fodders shredded corn stover and silage and under certain conditions cotton-seed hulls, pea vine, sorghum, and other home-grown hays.

"To the concentrates named it may be profitable in certain cases to add a small quantity of corn, or corn and cob meal, but this is extremely doubtful.

"This does not afford us a very large variety of feeding stuffs, and yet it is quite practicable to feed cattle for from 4 to 6 months on corn stover, silage, cotton seed and cotton-seed meal with quite satisfactory results both as regards the daily gains made by the cattle and the financial returns from the operation. . . . The usual high price of corn precludes its extensive use in this State. . . .

"The same facts and reasoning as above applied to the feeding of corn probably also apply to all other high-priced grains or concentrates, such as wheat bran, rice products, gluten feeds, etc. In long feeding periods, small quantities of these feeds may possibly be used advantageously, but even this is doubtful, and it is quite certain that as a general rule the average feeder will not find their use profitable in any quantity."

Sample rations are suggested suitable for different breeds of fattening steers.

In a discussion of feed lots and shelters, the feeding barn and lots in use at a test farm of the State department of agriculture are described.

Cattle-feeding experiment, W. BRUCE (*Edinb. and East of Scot. Col. Agr. Bul. 10, pp. 25-36*).—A liberal v. a limited ration of turnips and moderate v. heavy feeding was studied in continuation of earlier work (E. S. R., 17, p. 1003) with 3 lots of 8 steers each, the feeding period covering 138 to 150 days.

On a ration of 90 lbs. turnips with oat straw ad libitum and a daily allowance of 6 lbs. of Bombay cotton-seed or other cake the average daily gain per head was 1.78 lbs. With both turnips and straw ad libitum and the same amount of cake as before the average daily gain was 1.75 lbs. per head. When the cake was increased 50 per cent and the turnips and straw were the same as with the first-mentioned lot the average daily gain was 2.02 lbs. per head. The cost of a pound of gain in the 3 cases was 12 cts., 13 cts., and 11.9 cts., respectively.

A similar lot of 8 cattle was fed, at the time of the above test, for 120 days turnips and straw with a variety of concentrated feeds and made an average daily gain of 2.05 lbs. per head, the cost of a pound of gain being 12.5 cts.

Sheep-feeding experiment, W. BRUCE (*Edinb. and East of Scot. Col. Agr. Bul. 10, pp. 1-42*).—Continuing earlier work (E. S. R., 17, p. 896) different concentrated feeds were tested, turnips and hay constituting the coarse fodder of the rations. The special feeds were Bombay cotton-seed cake alone and mixed with linseed cake and crushed oats, linseed cake, dried distillers' grains, and decorticated cotton-seed cake with crushed maize. Each lot contained 30 sheep and the test covered 85 days.

The greatest gain, 2.54 lbs. per head per week, was made on the linseed cake ration and the smallest gain, 2 lbs. per head per week, on the Bombay cotton-seed cake and oats 1 : 1. With the latter ration the gain was most expensive.

costing 9.28 cts. per pound. The gain was most cheaply made on the dried distillers' grains, costing 8.6 cts. per pound.

One of the points discussed in the report is the returns obtained per acre from the turnips used in the various rations.

Feeding fermented cotton-seed meal to hogs, F. R. MARSHALL (*Texas Sta. Bul. 78, pp. 20, figs. 8*).—Since it has been claimed that feeding fermented cotton-seed meal to pigs by the so-called Allison method gives satisfactory results inquiries were sent to a number of feeders in Texas requesting data based on their experience, and a feeding test was undertaken in which fermented cotton seed meal and corn chops 1 : 2 and 1 : 1 were compared with corn chops fed in the usual way and fermented. There were 10 pigs in each lot and the test covered 83 days.

The lot fed unfermented corn chops made an average daily gain of 0.49 lb. per head at a cost of 8.4 cts. Similiar values for the lot fed fermented corn chops were 0.39 lb. and 9.57 cts. The feed eaten per pound of gain in the 2 cases was 7.62 and 8.68 lbs. The lot fed fermented cotton-seed meal and corn chops 1 : 2 made an average daily gain of 0.46 lb. per head at a cost of 8.06 cts., 7.27 lbs. of feed being required per pound of gain. One of the pigs in this lot died very near the end of the experimental period and another ceased to make gains, and so was not marketed with the rest of the lot. The pigs fed fermented cotton-seed meal and corn chops 1 : 1 made an average daily gain of 0.34 lb. at a cost of 11.1 cts., 10 lbs. of feed being required per pound of gain. Sickness was noted in this lot as early as the sixty-fifth day of the trial and 3 pigs died before its close.

The results of slaughter tests made with the 4 lots are reported. The principal conclusions which were drawn from the test as a whole follow:

"The reports of feeders who have used cotton-seed meal for hogs indicate that a light feed of cotton-seed meal may be continued indefinitely and that the consumption of green feed lessens the danger of death from feeding cotton-seed meal.

"A comparison of the results of this experiment with those of other stations at which cotton-seed meal was fed in the ordinary way indicates that cotton-seed meal may be used in larger quantities and for longer periods when fermented and fed in a slop than when fed without being fermented.

"In this trial the hogs were yard fed during the hot summer season, consequently they were under conditions making the trial as severe as possible. Under such conditions fermenting cotton-seed meal does not entirely remove its injurious effect when fed to hogs.

"The results of this experiment show that for the first 43 days of the feeding the mixture containing cotton-seed meal and corn gave larger and cheaper gains than the straight corn ration, while during the second period of 40 days the results were reversed. This leads to the suggestion that, to improve a corn ration, it would be advisable to add cotton-seed meal to it for about 40 days, preferably, for other reasons also, during the last 40 days of the feeding.

"The hogs that received cotton-seed meal as a part of their ration in this trial showed less fat and more lean meat in the carcass.

"The carcasses of the hogs that received cotton-seed meal, contrary to the previously expressed opinion of the packers, were firmer and therefore more acceptable to them than those of the corn-fed hogs."

To those who wish to feed cotton-seed meal to pigs, the author recommends that for animals on heavy feed not more than one-fourth of the total weight of the grain ration consist of cotton-seed meal. This feeding should not be continued for more than 50 days unless the proportion of cotton-seed meal be

reduced. The meal should be mixed with the other feed and all soured together. As much green feed as possible should also be fed and a close watch kept and the cotton-seed meal taken away from any animals not eating or not gaining well.

If cotton-seed meal and corn chops are mixed before the water is added the tendency for the meal to form into balls is obviated. In summer the mixture will sour readily in 24 hours. In cold weather 48 hours or longer will be required to produce the characteristic sharp odor. Souring will be hastened by adding to each lot of feed a quart of the sour material.

"Feeders who have had experience with the meal will probably be able to exceed these recommendations, which, however, allow the use of enough meal to greatly improve a corn diet. One lb. of cotton-seed meal to 5 of corn furnishes the nutrients in the most desirable proportions for fattening, while 1 to 2 of corn are more nearly correct for young growing stock. Of course other feeds are desirable for their influences not attributable to their composition, but it is not often that the adopted standards can be ignored in feeding any animals for profit."

Egg farming—infertile eggs, M. Fern (*Queensland Agr. Jour., 17 (1906), No. 5, pp. 229, 230*).—The superiority of infertile eggs is insisted upon, and a test is briefly reported in which a large proportion of such eggs, stored at ordinary temperatures, kept fresh for more than 2 months.

Ostrich farming as carried on at the present day, A. W. Douglass (*Transvaal Agr. Jour., 5 (1906), No. 17, pp. 92–95*).—The present systems of ostrich farming in the Transvaal are pasturing on alfalfa or feeding alfalfa hay and ranching the ostrich or running the birds in camps on the natural veld. Some advantages of each of the two systems are briefly described and data given regarding ostrich enemies and parasites.

"The two great scourges to the ostrich farmer are that the birds in their younger stages are invariably infested with tapeworm, and still worse with Douglassi or wireworm. These are overcome to a great extent by dosing the young birds with turpentine and other mixtures, and the older the bird becomes, the freer it becomes of these parasites; the reason why is as yet unknown."

The turtle trade of the West Indies, W. G. Fitz Gerald (*Sci. Amer., 95 (1906), No. 20, pp. 365, 366, figs. 4*).—Turtle fishing, feeding, marketing, the manufacture of canned and bottled turtle products, and other features of the West Indian turtle trade, which centers at Kingston, Jamaica, are discussed.

DAIRY FARMING—DAIRYING—AGROTECHNY.

Experiments for the determination of the protein minimum in rations for dairy cows (*Ber. K. Vet. og Landbohöjskoles Lab. Landökonom. Forsög [Copenhagen], 60 (1906), pp. 1–147+1–158*).—The investigation reported in this publication was conducted for the purpose of determining the quantities of nitrogenous substances required by milch cows, especially minimum protein requirements.

Nine fresh cows were placed on the experiments planned for the study of this question, and were fed rations containing varying proportions of hay, straw, mangels, and cotton-seed meal. The nitrogen balance was determined throughout the experiments by collecting the solid and liquid excreta, which were weighed and analyzed as in the case of the feeding stuffs used on the experiments.

The following table gives a summary of the average results obtained. These are published, however, as only approximate figures, since the minimum must

necessarily vary considerably with different cows, according to their ability to utilize their feed, the kind and quality of the feed eaten, and the amount and character of milk produced, especially its nitrogen content.

Approximate minimum of nitrogen for dairy cows.

Daily yield of milk.	Rations fed. Cotton-seed meal.	Mangels.	Hay.	Straw.	Total nitrogen.	Nutritive ratio.
Kg.	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Grams.*	
16	1.50	45	2.5	5	200	1.9
13	1.25	48	2.5	4	182	1.10
10	1.00	51	2.5	4	165	1.11

It will be seen that the minimum protein content of rations for milch cows, according to these results, will range between 2.75 and 2.28 lbs. for cows producing 35 to 22 lbs. of milk containing 3 to 4 per cent of fat. In the rations as fed, these amounts corresponded to about 2.06 to 1.70 lbs. of digestible protein per head daily.

The conditions under which changes occur in the protein requirements of dairy cows and the physiological effects of variations in the supply of protein in the rations are discussed at considerable length in the report, as well as the bearing of the results of the investigation on mooted questions of methods of study of feeding problems with dairy cows.—F. W. WOLL.

The fat content of cows' milk, its normal variations and transmission, K. A. HÖGSTRÖM (*K. Landtbr. Akad. Handl. och Tidskr., 45 (1906), No. 3–4, pp. 137–176*).—This investigation was conducted with a large herd of pure-bred or high-grade Ayrshire cows during a period of eight years, the object in view being to study the causes of normal variations in the fat content of cows' milk, aside from immediate changes brought about through the influence of differences in weather or temperature conditions, manner of feeding, etc., and to determine, if possible, the laws of transmission of the quality of the milk. The material at hand included nearly 18,500 fat determinations in the milk from 393 cows. These calved throughout the year, although more freshened during the fall months than in the spring.

The author discusses variations in the fat content of milk under three headings—accidental variations, depending on exterior influences affecting the nervous system of the cows; normal variations, based upon the nature of the cows; and individual variations, depending on hereditary influences. Only influences coming under the last two headings are discussed in this paper.

Under normal variations are considered the following:

(1) The periodical variation for the lactation of the cow: The fat content of the milk, which at the beginning of the period is above average, falls rapidly and reaches its minimum during the third month from calving, after which there is a gradual increase until a maximum is reached at the close of the lactation. The average data for all cows obtained by the author for the first to the thirteenth months from calving were as follows: 3.75, 3.57, 3.50, 3.54, 3.61, 3.67, 3.78, 3.89, 3.99, 4.09, 4.14, 4.13, and 4.15 per cent.

(2) The periodical variation for the life of the cow: The fat content is highest at three years of age, is high at four years, and remains close to the average for the family during the full activity of the cow, after which it again rises slightly. The average of all data was as follows: Third year, 3.83 per cent; fourth, 3.74 per cent; fifth, 3.65 per cent; sixth, 3.65 per cent; seventh, 3.66 per

cent; eighth, 3.69 per cent; ninth, 3.65 per cent; tenth, 3.67 per cent; and over 10 years, 3.75 per cent; general average of 799 lactations, 3.69 per cent.

(3) Variations according to the month of the year: Normal fat content in April, strong depression in May, June (minimum, 3.45 per cent), and July; again average in August and rapid increase in September, with maximum (3.96 per cent) in October; and slightly varying fat contents during the winter months.

(4) Variations according to the place of the month of calving in the calendar year: Increased average fat contents in periods beginning in March, August, and September, and decrease in periods beginning in May and October. This variation is a direct result of the preceding one.

(5) The different power of cows for larger or smaller production: Cows yielding abnormally little milk have higher fat contents, and an abnormally high milk yield is accompanied by a lower fat content, while a milk yield falling within the natural variations of a family shows a normal fat content.

(6) Changes in the normal milk production depending upon changes in the system of feeding: The milk yield stands in an inverse ratio to the fat content. The variation refers to an entire year and months, as well as to short periods. The variations in the fat content are, however, much smaller than that of milk production.

The curve for the average monthly fat content of the milk for the calendar months April to October was found to correspond in a striking manner to the corresponding part of the curve for cows calving in March to April, and the author traces the cause on the hypothesis that March and April is the natural calving time for cows, and that they, therefore, continue to change the fat content of the milk throughout the summer months in such a way as is best for the calf when dropped at normal calving time. It is also shown that the difference in the production of milk and fat during an entire lactation period caused by the time of calving are very marked, amounting in the case of cows calving in March and in August to about 18 per cent. In general, the milking periods commencing during the winter months give larger yields than those that commence during the summer.

The influence of the individual variations was studied by the statistical method, as was that of the normal variations. In this case, however, no such large material was available. The largest series that was obtained consisted of 76 daughters, but most of these, as well as their dams, were tested for more than a year. In all, 584 determinations of the yearly fat production were made in the case of the progeny of, or dams mated to, the four bulls included in the investigation. Briefly stated, the conclusions drawn from this study are as follows: The lower the fat content of the dam's milk, the more that of the daughters is increased by the sire. If the fat contents of both parents appreciably exceeds that of the average for the family, their united influence is not able to increase the fat content of the daughters to the average of that of the parents, against the influence of the family, but it will remain below that of the parents. The fat content of the daughters is never the average of that of the parents, but comes near to the average of the family. While the variations studied in these investigations can not be taken to apply in all details to other herds and breeds of cattle, they may safely, in the author's opinion, be considered of general value, with the distinct limitation that their extent and their development in certain directions may vary in different families and breeds.—F. W. WOLL.

Cow testing associations, with some notes on the sampling and testing of milk, J. A. RUDDICK and C. F. WHITLEY (*Canada Dept. Agr., Dairy Comr.*

Branch Bul. 12, pp. 14, figs. 5).—More than 20 cow-testing associations have been organized in the provinces of Ontario and Quebec and the movement is said to be extending rapidly. This bulletin serves as a sort of popular manual for this purpose, as it contains rules and regulations for such organizations and directions for carrying on the work.

Milking machines, O. Erf (*Kansas Sta. Bul. 140, pp. 67, figs. 50*).—This bulletin contains a statement of the principles upon which milking machines have been constructed; illustrated descriptions of over 70 of the more important machines, classified under milk tubes, pressure machines, and suction machines, which have been invented since the practical beginning of work along this line in 1878; detailed directions for installing and operating milking machines; and a report upon experiments conducted at the Kansas Station.

The success of machine milking in practice as compared with hand milking depends, according to the author, upon several factors, among which are the reduction in cost of labor, maintenance of both the quantity and quality of the milk, cleanliness of the milk, the possibility of using the machine for the average cow, reliability of the machine, and the returns for the capital invested.

In securing data upon the reduction and cost of labor, hand milking and machine milking were compared at intervals on 17 cows. Averaging the data for 3 milkers, it was found that the time required to milk a cow was 9.44 minutes and the yield of milk 12 lbs. or 1.27 lbs. per minute. With a milking machine, the time required to milk two cows averaged 7.1 minutes, the rate per minute being 2.3 lbs. Three machines managed by 1 man would, therefore, according to these results, be better than five milkers, but this takes into consideration only the time actually employed in milking and not that required for putting the machine in operation, taking care of the engine, etc.

The author considers that sufficient experimental work has been done to prove that no great decrease in the quantity and quality of milk can result from the use of milking machines. The results of 32 tests showed that the average cow was milked slightly cleaner by machine than by hand.

In 12 experiments, milk taken from the milking machine remained sweet for a longer time, varying from 1 to 10 hours, than that obtained by hand, the samples in both cases being kept under identical conditions at a temperature of 60°. At 32°, machine-drawn milk remained sweet 6 to 38 hours longer than that obtained by hand. Bacteriological tests also showed the superiority of the milking machine over hand milking as regards cleanliness.

Tests were made of boric acid, lime, and formaldehyde for sterilizing the milking machine. One per cent solution of formaldehyde was the most effective. Boric acid was the most expensive and least effective, but did not injure the tin. Lime, on account of its cheapness, is considered the most practical where large quantities of antiseptic materials are to be used.

In no instance did cows indicate any discomfort from the use of the machines. The machines used at the station have been found to be very durable.

The author considers that for a small dairy the investment in a milking machine at present prices would be unprofitable. For dairies of 50 cows or more, however, it is considered a good investment. Several tests were also made as regards the most satisfactory number of pulsations per minute and the proper amount of vacuum. With the machine used, this was found to range from 45 to 53 pulsations per minute and 16 to 17 lbs. of pressure.

On the formation of lactose, F. H. A. Marshall and J. M. Kirkness (*Bio-Chem. Jour., 2 (1906), No. 1-2, pp. 1-6*). The experiments here reported were undertaken to test P. Bert's hypothesis recently supported by the work of Porcher (E. S. R., 17, p. 287) that lactose is formed in the mammary gland from glucose in the blood. The work consisted in removing the mammary glands

from guinea pigs and testing for glycosuria before and after a subsequent parturition. Three experiments failed to show any glycosuria following parturition nor any increase in the glucose in the blood at that time. On the other hand, a glycosuria was occasionally observed after parturition in normal unoperated animals. It is considered probable that the glycosuria observed by Porcher was a post-operative effect. This work, therefore, confirms the view that the complete process of lactose formation takes place in the cells of the mammary gland.

Homogenized milk, M. J. EURY (*Indus. Lait.* [*Paris*], *31* (*1906*), *No. 48*, *pp. 777–779*).—Analyses were made of raw and sterilized milk before and after treatment by the method of Gaulin. In the untreated milk the fat globules were often 10 microns in diameter, while in the homogenized milk they scarcely reached a diameter of 3 microns. The determination of fat by the Gerber method showed a lower percentage as a result of treatment. The Adams method, however, was unaffected. The same result was obtained by the Gerber method when the period of centrifuging was prolonged to 10 minutes. In general, the composition of the milk before and after homogenizing was identical, showing that this treatment did not modify the composition of the milk.

Investigations on the source and distribution of organisms of ropy milk, M. SCHNEEBELI (*Schweiz. Milch. Ztg., 1906, No. 45; abs. in Rev. Gén. Lait, 6* (*1906*), *No. 2, p. 44*).—The lactic bacteria capable of producing viscous fermentation are not believed to be widely distributed. Occasionally, however, a dairy may become badly infected with such organisms. An instance of this kind was investigated.

The pathogenicity of Streptococcus lacticus, P. G. HEINEMANN (*Jour. Infect. Diseases, 4* (*1907*), *No. 1, pp. 87–92*).—Brief reference is made to investigations bearing upon the pathogenic action of streptococci isolated from milk, the conclusion being drawn from the review that such organisms, when freshly isolated and not originating from mastitis do not possess high virulence. In an earlier article (E. S. R., 17, p. 1007) the author reported the constant occurrence of *Streptococcus lacticus* in milk and considered this organism identical with *Bacillus lactis acidi* and also identical in morphological and cultural characters on ordinary media with *S. pyogenes*.

In the present investigations the aim was to determine if the virulence of *S. lacticus* might be increased by successive passages through animals. Five strains of *S. lacticus* from different sources and three of *S. pyogenes* were used. The conclusion drawn from the investigations is that these two organisms are closely related not only in morphological and cultural characters but in pathogenic properties. The virulence of *S. lacticus* was gradually increased by repeated passages through rabbits so that after five or more passages, 2 cc. of a 24-hour-old broth culture was fatal in subcutaneous injections. The same amount injected intravenously was fatal to the first animal. The lesions of *S. lacticus* in rabbits were the same as those produced by *S. pyogenes* in man.

Report of the butter laboratory in Hängo, Finland, 1904, G. A. BREDENBERG (*Landtbr. Styr. Meddel., 52* (*1906*), *pp. 30*).—The report gives an account of the first year's work of the laboratory established in connection with the Finnish export butter exhibits. The output of 221 creameries was examined during the year. The results of the determinations on 1,051 samples of the refractive index and contents of volatile fatty acids, respectively, by months are as follows: January, 50.5, 30.4; February, 50.4, 30.8; March, 50.9, 31.1; April, 50.4, 31.8; May, 51.8, 31.9; June, 51.4, 30.4; July, 52.1, 29.3; August, 52.8, 28.2; September, 53.0, 27.8; October, 51.9, 28.4; November, 50.5, 29.7; December, 50.0, 31.7; maximum, 54.0, 33.7; minimum, 49.0, 25.9; and average, 52.5, 28.0.

No relation could be traced between the volatile-acid content of the butter fat and the quality of the butter. The average water content of all samples examined was 13.59 per cent, the extremes being 10.24 and 18.72 per cent. Of the samples examined 79.1 per cent contained between 12 and 15 per cent of water, and only 3.9 per cent contained more than 16 per cent. The water content of the butter was, as a rule, somewhat higher during the pasturing season than on stable feeding, the averages being respectively 13.63 and 13.44 per cent.—F. W. WOLL.

The butter trade in Denmark, France, and Holland, HOLLMANN, HAILER, and I. FROST (*Ber. Land u. Forstw. Auslande, 1906, No. 13, pp. 38*).—This contains statistical and other information concerning the sale of butter in these countries.

Influence of pepsin upon the ripening of Limburg cheese, L. MARCAS and C. HUYGE (*Rev. Gén. Lait, 6 (1906), No. 2, pp. 25–33*).—A series of experiments were undertaken to determine the influence of pepsin on the ripening of this cheese. According to the results obtained, the addition of rennet increased the amount of soluble nitrogenous products. The increase, however, was not proportional to the quantity of pepsin added. The influence of pepsin was most marked during the first few weeks following the manufacture of the cheese, when the acidity was high. While the analytical results show, therefore, that pepsin plays a useful rôle in the ripening of this cheese, the judgment of experts on the quality of the cheese was not in accord with this view. Chemical analysis as a means of determining the ripening of cheese is therefore considered of doubtful value.

Action of rennet on milk, B. SLOWTZOFF (*Beitr. Chem. Physiol. u. Path., 9 (1907), No. 3–4, pp. 149–152*).—The results of experiments by the author agree with those of Petry (E. S. R., 18, p. 475) in that whey albumin is not formed solely at the time casein is changed into paracasein, but continues to increase in amount after that stage. According to the author, rennet must either be considered as containing two ferments—one coagulating and one proteolytic, or that coagulation with rennet is merely the first step in the digestion of the casein.

Fundamental dairying and dairy arithmetic, O. ERF (*Manhattan: Kansas Agr. Col., 1906, pp. 49*).—This constitutes a popular treatise in the form of questions and answers. Particular attention is paid to calculations of use in dairying.

First national congress of dairying (*1. Cong. Nat. Indus. Lait., 1906, Annexe Raps. et Compt. Rend., pp. 148–250*).—This is a report of the proceedings of the French Dairy Congress held in Paris, March 12–13, 1906. Papers were presented upon the cooling of milk, the physical condition of cream, pasteurization in butter making, the food value of casein, and the selection of cows. Reports on 15 dairy subjects were also made and discussed.

Pure yeast in wineries, F. T. BIOLETTI (*California Sta. Circ. 23, pp. 4*).—The author does not advocate the general use of pure yeasts in wine making at the present time. Under favorable conditions, however, the method is believed to have decided advantages, such as a thorough fermentation, a rapid clearing, and an absence of the disagreeable flavors of secondary fermentation. These benefits which have been demonstrated by both laboratory and cellar experiments are, however, not to be secured unless special care is exercised. This circular is, therefore, intended for the more progressive wine makers who desire to improve their product.

The station has isolated a yeast which has uniformly given good results in practical tests and has prepared a small quantity for distribution to a limited

number of wine makers. Directions for the use of pure yeasts are given in this circular.

Defecation of must for white wine, F. T. BIOLETTI (*California Sta. Circ. 22, pp. 4*).—A method of using sulphur fumes for this purpose is given and arguments in favor of the process are summarized as follows: "(1) It eliminates the worst of the impurities before they have contaminated the wine; (2) it diminishes the amount of sediment in the casks at the first racking; (3) it causes the wine to clear much more rapidly after fermentation; (4) it eliminates much of the albuminoid substances which are the preferred food of injurious bacteria; (5) it clears the wine of most of the molds, wild yeasts, and bacteria; and (6) it enables us to use pure yeast with the greatest effect."

Beet-sugar manufacture, H. CLAASSEN, trans. by W. T. HALL and G. W. ROLFE (*New York: John Wiley & Sons; London: Chapman & Hall, Ltd., 1906, pp. XIV+280*).—This is an authorized translation from the second German edition of this treatise.

A practical handbook on the distillation of alcohol from farm products and the denaturing of alcohol, F. B. WRIGHT (*New York: Spon & Chamberlain; London: E. & F. N. Spon, Ltd., 1906, pp. VIII+194, figs. 33*).—This treats of the various sources of alcohol and the methods by which it is obtained, methods of determining the quantity of alcohol in spirituous liquors, and the preparation and use of denatured alcohol.

VETERINARY MEDICINE.

Treatise on domestic animals in health and disease, A. KOCH (*Lehre von den Gesunden und Kranken Haustieren. Vienna: M. Perles, 1907, pt. 1, pp. VI+314, figs. 291*).—The present volume is intended to show in its treatment of the subject the relationship between veterinary science and modern agriculture. In the care of domestic animals considerable knowledge of the anatomy, physiology, and common diseases is necessary in order to make a success of the business. The author has presented the material contained in the volume especially for the use of students and stock raisers.

Part 1 relates to the conditions of health in domestic animals and includes a discussion of the cellular structures and organs of locomotion, digestion, circulation, and other parts of the body.

A text-book upon the pathogenic bacteria, J. MCFARLAND (*Philadelphia and London: W. B. Saunders Co., 1906, 5. ed., pp. 648, figs. 180*).—In preparing the present edition of this text-book, the chapters on infection and immunity have been entirely rewritten in order to bring them abreast of modern research. The volume contains a general account of the growth and distribution of pathogenic bacteria on various substances. Specific descriptions are given of the common infectious diseases of man and animals.

The toxins and venoms and their antibodies, E. POZZI-ESCOT, trans. by A. I. COHN (*New York: John Wiley & Sons; London: Chapman & Hall, Ltd., 1906, 1. ed., pp. VII+101*).—Research in the field of toxins has been so active in the past 20 years that convenient handbooks dealing with the essential points have become a practical necessity. The present treatise contains an account of alkaloid toxins, bacterial toxins, vegetable toxins, and venoms as obtained from various species of animals.

The rôle of leucocytes in the defense of the organism against infection, M. PETTERSSON (*Centbl. Bakt. [etc.], 1. Abt., Orig., 42 (1906), No. 1, pp. 56–63*).—The author's experiments were carried out on guinea pigs and rabbits with cultures of vibrio. In order to note the action of leucocytes upon the

pathogenic organism these corpuscles were transferred from one animal to another which had recently been inoculated. The author concludes from his experiments that the serum and leucocytes cooperate in protecting the animal organism against infection. In this work the serum attacks the bacteria directly, while the leucocytes assist in counteracting and destroying bacterial toxins.

Causes of the diminution of natural resistance to infection, R. TROMSDORF (*Arch. Hyg., 59 (1906), No. 1, pp. 1–90*).—The present article is a contribution to the study of immunity. The author carried on an extensive series of experiments, the results of which interpreted partly in the light of other experiments along the same line may be briefly summarized in the statement that while there may be other factors in determining the degree of immunity, the motile power of the leucocytes, the ability of certain cells to form alexins, and the power of the organism to produce specific protective bodies are the chief factors concerned.

The relation of autolysis to the histological changes occurring in necrotic areas, H. G. WELLS (*Jour. Med. Research, 15 (1906), No. 1, pp. 149–165*).—A chemical and histological study was made of the changes which take place during the necrosis of the tissue. There is first a decomposition of the nucleoproteids in ordinary infarcts. The proteid structure of the cell is attacked by proteolytic enzyms and such infarcts are absorbed through a digestive action of the leucocytes.

Report on the proceedings of the free society for micro-biology in the institute for infectious diseases in Berlin, A. WASSERMANN (*Centbl. Bakt. [etc.], 1. Abt., Ref., 38 (1906), Beiheft, pp. 120, pl. 1*).—The free society for microbiology met in Berlin, June 7–9, 1906, and at these meetings a large number of papers dealing with bacteriological problems was read. The author has prepared a summary of the most important points contained in these papers. Particular attention was given to a discussion of the problems of immunity, the general one being stated by R. Kraus; immunity toward anthrax, by Gruber; toward vibrio in pigeons, by R. Pfeiffer and R. Scheller; and toward plague, by Löhlein. Among the other matters of interest from the veterinary standpoint were a discussion of the quantitative relation of tubercle bacilli to infection, by Flügge; the properties of serum in cases of tuberculosis, by Sobernheim; and the etiology of roup, by R. Müller.

Transmission of resistance to diphtheria toxin by the female guinea pig to her young, J. F. ANDERSON (*Jour. Med. Research, 15 (1906), No. 2, pp. 241–260*).—The possibility of the transmission of immunity to disease is being studied from every standpoint, and the present article is a distinct contribution to the subject in that the author's experiments showed that ordinarily all of the young of different litters from a female guinea pig previously immunized to diphtheria were in turn immune to the disease. Such immunity, however, was not transmitted to the second generation. A distinct cumulative effect was observed from the repeated use of diphtheria toxin. In further experiments it was found that the female guinea pig may transmit simultaneously to her young an immunity to diphtheria toxin and a greatly increased susceptibility to horse serum.

The pathogenic action of blastomycetes injected into the trachea, F. SANFELICE (*Centbl. Bakt. [etc.], 1. Abt., Orig., 41 (1906), Nos. 1, pp. 61–71; 2, pp. 195–200; 3, pp. 332–338, pl. 1*).—The author's experiments were made on guinea pigs and rabbits, and a considerable variety of blastomycetes were used, including *Saccharomyces canis* and *S. neoformans*. The effect upon the tissue

of the trachea varied in different cases. Giant cells were sometimes formed by the fusion of epithelial cells.

It appeared during these experiments that the differences between malignant growths and benign forms of irritation set up by organisms such as those used by the author are not always sufficiently striking to enable one to make the diagnosis.

Experiments in examination of the locked jaw induced by tetanus toxin, H. E. ROAF and C. S. SHERRINGTON (*Jour. Physiol., 34 (1906), No. 4–5, pp. 315–331, charts 4*).—The experiments, the results of which are here reported, were carried out on monkeys.

It appeared that after the division of the lower jaw at its symphysis the stimulation of the corresponding area of the brain cortex caused an opening of the jaw. After inoculation of the facial nerve with tetanus toxin the stimulation of the same area of the brain caused a closing of the jaw. This change was more pronounced during the early stages of intoxication. The authors are of the opinion, however, that the cerebral cortex was not affected by the tetanus toxin, but the changes in the reactions obtained took place in some of the lower brain centers.

The treatment of tetanus by the method of Baccelli, G. BIANCHEDI (*Clin. Vet. [Milan], 29 (1906), No. 39, pp. 937–951*).—The results obtained by the author in experiments with this method agree largely with his own observations in indicating for it great practical utility, but not an absolute infallibility.

Danysz' reaction, T. MADSEN and S. ARRHENIUS (*Meddel. K. Vetensk. Akad. Nobelinst., 1 (1906), No. 3, pp. 1–20, figs. 3*).—In a study of the reactions between the toxin of tetanus and its antitoxin, it has been demonstrated that after the tetanus toxin has been neutralized by the antitoxin a new reaction takes place if the antitoxin is in excess. This second reaction consists in a fixation of a relatively large amount of antitoxin and is known as Danysz' reaction. The reaction depends upon the excess of antitoxin over the toxin.

Infection in tuberculosis, A. E. METTAM (*Vet. Rec., 19 (1906), No. 951, pp. 182–186*).—Brief notes are given on tuberculosis in birds, dogs, cats, pigs, horses, and cattle. As a result of the investigations already made on methods of controlling the disease the author believes that healthy animals may be protected by the Bang method or by the vaccination method recently perfected by Calmette, Guerin, and Vallée.

Immunization to tuberculosis, P. HAAN (*Rev. Gén. Méd. Vét., 8 (1906), No. 91, pp. 349–356*).—The author reviews in a critical manner the various schemes which have been proposed for the immunization of cattle and other animals toward tuberculosis. It is admitted that much promise is given by the results thus far obtained but that at present we are still in need of a method which will give certain results in combating the disease.

Cornstalk disease, R. A. CRAIG (*Indiana Sta. Circ. 3, pp. 10*).—A disease which was referred to by this name appeared quite extensively in Indiana during 1902 and 1906. Reports were obtained from a number of observers, some of them veterinarians, concerning the symptoms of the disease and circumstances surrounding outbreaks. Moldy corn was obtained from a field where cattle had developed the disease and was fed to a heifer at the rate of 4 to 5 lbs. twice per day. At the end of 6 days the heifer showed considerable weakness and other pathological symptoms but the weakness disappeared the following day and the appetite remained good during a period of 16 days.

The theories held by different observers regarding the cause of cornstalk disease are briefly summarized. The conclusion is reached that there are probably several diseases referred to under the same name. While the symptoms resemble those of toxic poisoning it is by no means certain that

potassium nitrate in the corn is the cause of the trouble. It is suggested that prussic acid may at times be developed in corn.

Treatment of milk fever, RABUS (*Wchnschr. Tierheilk. u. Viehzucht, 50 (1906), No. 39, pp. 766–768, fig. 1*).—A description is given of a suitable apparatus for use in inflating the udder with filtered air in cases of milk fever. The apparatus is claimed to possess the advantages of simplicity and ease of cleaning.

Ranula inflammatoria in cows, E. WYSSMANN (*Schweiz. Arch. Tierheilk., 48 (1906), No. 5, pp. 323–333*).—This disease is known under a number of other names, such as inflammatory edema, frog tumor, etc., and attacks the tongue at the base of this organ and also the submaxillary and sublingual glands and connected structures. The usual form of lesion is a tumor or a multilocular cyst.

The author had occasion to study a number of cases of this sort and gives a detailed clinical history of one case. The tumor was painted 3 times daily with a tincture of iodin and chloroform, and potassium iodid was administered internally in an aqueous solution. A septicemic infection spread from the tumor, causing symptoms which resembled those of malignant catarrhal fever, but recovery ultimately took place.

The alterations in the mucous membrane in cases of strongylosis in cattle, J. BLUNSCHY (*Schweiz. Arch. Tierheilk., 48 (1906), No. 5, pp. 291–323, pls. 2, fig. 1*).—A careful microscopic study was made of the lesions caused by strongylus in the walls of the fourth stomach and duodenum. Although strongylus is a common parasite of cattle it becomes definitely located only in the stomach and small intestines.

The parasites penetrate into the folds of the stomach walls and the tubes of the glands. After reaching the muscular coat they cause an enlargement of the gland tubes and coil up spirally. In this position they may cause nodules in which a pronounced necrosis of tissue takes place. The healing process is accomplished by the substitution of connective tissue. In the small intestine strongylus attacks mostly the lymph follicles, but in the posterior part of the small intestine a considerable degeneration of the epithelium is observed.

Fatal hemorrhage as a result of a tuberculous ulcer of the fourth stomach, E. PLATE (*Berlin. Tierärztl. Wchnschr., 1906, No. 39, pp. 713, 714*).—A careful post-mortem examination of a case of this sort showed that the lymphatic glands were enlarged and infected with tubercle bacilli and that an ulcer of tuberculous nature had developed so extensively in the wall of the fourth stomach as to cause fatal hemorrhage.

Poisoning from the use of spoiled brewers' grains, SCHILFFARTH (*Wchnschr. Tierheilk. u. Viehzucht, 50 (1906), No. 25, pp. 484, 485*).—Three cattle died as the result of eating spoiled brewers' grains. The liver showed fatty degeneration and a grayish yellow color. The mucous membrane of the fourth stomach and intestines was also loosened and somewhat infiltrated. At the same time 4 cows showed mild symptoms of poisoning, but ultimately recovered.

Nodule disease of the intestines of sheep. "Bare-lot" method of raising lambs, W. H. DALRYMPLE (*Louisiana Stas. Bul. 89, pp. 11, figs. 5*).—A further test was made of the method already proposed by the Louisiana Station for the control of nodular disease in lambs (E. S. R., 17, p. 405). The results obtained in the second test indicate that lambs may be successfully raised on bare lots from ewes badly infested with the nodule worm. The barelot method seems not to prevent entirely the infestation with stomach worms.

Epizootic gangrenous mammitis in ewes, DETROYE (*Bul. Soc. Cent. Méd. Vét., 83 (1906), No. 18, pp. 452–457*).—An outbreak of this disease of great virulence occurred and spread with unusual rapidity. An experiment was made

in injecting a 2 per cent solution of carbolic acid into the affected parts of the udder. The immediate result of repeated injections of this sort was to check the progress of the disease and apparently to destroy the micro-organism, but the tissue of the udder sloughed off as a result of the previous infection and treatment. This method may be of value in preventing the spread of the infection, but in curing the disease the author recommends the surgical method of the removal of all affected tissue.

A disease of the pig due to Spirochæta, S. DODD (*Jour. Compar. Path. and Ther., 19 (1906), No. 3, pp. 216–222, pl. 1, fig. 1*).—Several species of this genus are known to be pathogenic for animals, but the one observed by the author was not found in the blood circulation but in skin lesions over the surface of the body. A post-mortem examination of affected pigs showed almost no characteristic pathological conditions outside of the skin lesions except anemia. Inoculation experiments with the blood of affected hogs showed that the parasite was not present in the blood. It was found that the disease was readily transmitted by contact.

Pseudoleukemia in pigs, ROTTKE (*Berlin. Tierärztl. Wchnschr., 1906, No. 39, pp. 712, 713*).—In cases of this disease the bronchial and mediastinal glands are greatly swollen and all of the lymphatic glands show a yellowish-white color. The musculature appears pale and the liver and spleen are somewhat enlarged. The author believes that some cases of pseudoleukemia will prove to be of a tuberculous nature.

Rachitis accompanied with spasms in pigs, FROMBERG (*Maanedskr. Dyrlæger, 18 (1906), No. 6, p. 255*).—In treating cases of rachitis in pigs complicated with symptoms of cramps, the author obtained satisfactory results from pumping air directly into the abdominal cavity by means of the ordinary apparatus to be used in the treatment of milk fever. The abdominal cavity was distended by pumping in air for a period of 7 to 20 minutes.

Susceptibility of ruminants and apes to the trypanosome of dourine, F. MESNIL and J. ROUGET (*Ann. Inst. Pasteur, 20 (1906), No. 9, pp. 689–697*).—It has generally been considered that ruminants and apes are not susceptible to dourine. In order to test this matter the authors undertook a number of inoculation experiments in which it appeared that cattle, goats, and apes may be infected with the trypanosome of dourine in the same manner as with other trypanosomes which are pathogenic for mammals.

The diagnosis of rabies, FORGEOT and NICOLAS (*Ann. Soc. Agr. Sci. et Indus. Lyon, 1905, pp. 390–404, figs. 8*).—The anatomical changes in the nervous system in cases of rabies are described with particular reference to Negri's corpuscles, which bodies were carefully studied by the authors.

The conclusion is reached that when Negri's corpuscles are found in Ammon's horn a positive diagnosis of rabies can be safely announced. The authors were unable to find Negri's corpuscles except in actual cases of rabies. This method of diagnosis suffers from certain disadvantages since the detection of Negri's corpuscles is a rather difficult one, and the process occupies considerable time and necessitates many complicated histological manipulations and the use of a high magnification. The results obtained in most instances, however, are sufficient recompense for the time employed.

The elevation of the body temperature through the treatment of rabies and infectious diseases, P. REMLINGER (*Compt. Rend. Soc. Biol. [Paris], 60 (1906), No. 22, pp. 1030, 1031*).—Rabies virus is well known as being very susceptible to the action of heat. The author suggests that this fact may be naturally connected with the rarity of rabies in birds on account of their high normal temperature and the infrequency of disease in the Tropics.

An attempt was made to determine the effect of heat in the treatment of

rabies. Animals were subjected to a high temperature and the internal temperature was raised by treatment with pilocarpin and other drugs, but no effect was observed on the progress of the disease.

Treatment of rabies by means of radium rays and the mechanism of their action, III, G. TIZZONI and A. BONGIOVANNI (*Centbl. Bakt. [etc.], 1. Abt., Orig., 42 (1906), No. 2, pp. 161–170*).—Among the 3 different kinds of radium rays with which the authors experimented in the treatment of rabies it was found that the kind which most closely resembles kathode rays is most effective, the other 2 being entirely without effect or merely assisting the action of the kind first named.

In the case of common laboratory animals it appears that by means of these rays a cure may be brought about provided the treatment is applied within 2 to 5 days after inoculation. The treatment must be continued 18 hours if postponed for 3½ days after inoculation, while less than one-half as much time is required if given immediately after inoculation.

The action of radium on rabies virus, G. TIZZONI and A. BONGIOVANNI (*Ann. Inst. Pasteur, 20 (1906), No. 8, pp. 682–688*).—This is a controversial article in which the authors reply to criticisms raised against their previous announcement regarding the effect of radium on rabies virus. A repetition of experiments planned in a manner similar to those carried out gave results which indicate that rabies in rabbits may be cured by the application of radium rays. The authors suggest the possibility of using radium in the same way in treating rabies in man.

The transference of rabies virus to frogs, J. VON LÖTE (*Centbl. Bakt. [etc.], 1. Abt., Orig., 42 (1906), No. 1, pp. 25–29*).—The literature of rabies contains few references to the possible transference of rabies virus to frogs. The author, therefore, undertook a number of experiments in which *Rana esculenta* and *R. temporaria* were inoculated with the virus of rabies. It was found possible to transfer the virus to frogs and after one or more transfers from frog to frog to inoculate warm-blooded animals with material thus obtained. The course of the disease produced by such material was, however, somewhat checked and it appeared that the virus was slightly attenuated as the result of inoculation in frogs.

A study of the so-called infectious lymphosarcoma of dogs, S. P. BEEBE and J. EWING (*Jour. Med. Research, 15 (1906), No. 2, pp. 209–227, pls. 3*).—This venereal disease of dogs is known in various countries in Europe and many cases have appeared in New York. The character of the tumors was carefully studied by the authors and it appears that the disease may be transmitted by the tumor cells. The active agent in the transmission of the disease or in the production of infection is not known.

Membranous angina of a pseudo-diphtheritic nature in dogs, V. BALL (*Jour. Méd. Vét. et Zootech., 57 (1906), Aug., pp. 449–456, fig. 1*).—The bacillus of human diphtheria may be transmitted by inoculation to a number of animals and birds, but the disease studied by the author and reported in the present article was of a pseudo-diphtheritic character. The symptoms were general debility, lack of appetite, and thirst. A persistent cough was present and the animal ultimately became unable to swallow. The disease may be complicated with hemorrhages and albuminuria, particularly if a general infection follows.

The treatment recommended consists in the application of local antiseptics such as salicylic acid, methylene blue, and carbolic acid, and the administration of tonics.

A new treatment of demodectic mange of dogs, L. DUPAS (*Bul. Soc. Cent. Méd. Vét., 83 (1906), No. 18, pp. 457–465*).—A great variety of remedies have

been recommended in the treatment of mange in dogs. In the author's experiments alcohol was tested for this purpose. The treatment consisted in thorough cleansing of the skin, after which alcohol was rubbed on the affected parts. The solution used in these experiments was obtained by adding 2 parts of 95 per cent alcohol to 100 parts of water. This treatment is not successful in all cases, but gives very satisfactory and certain results in cases of mange which have not been neglected too long.

The virus of fowl plague, K. LANDSTEINER (*Centbl. Bakt.* [etc.], *1. Abt., Ref., 38 (1906), No. 17-18, pp. 540-542*).—The author was unable to determine whether the virus of fowl plague is found inside the blood corpuscles or merely upon the outside surface. The virus may be separated by the use of the centrifuge with the aid of a 1 per cent salt solution. In order to obtain evidence which will help in determining whether the organism is protozoan or bacterial, the author subjected the virus to a 0.5 per cent solution of saponin in a 1 per cent salt solution. This solution quickly destroyed the trypanosomes, but did not affect ordinary bacteria or yeasts. Birds inoculated with virus treated with the solution remained alive, while control fowls inoculated with untreated virus died within 64 to 78 hours.

Immunization against fowl cholera with aggressins and bacterial suspensions, O. HUNTEMÜLLER (*Centbl. Bakt.* [etc.], *1. Abt., Orig., 42 (1906), No. 2, pp. 170-174*).—Previous investigations have shown that in the bodies of animals dying of certain infectious diseases an aggressin was found which had the effect of increasing the virulence of small doses of the pathogenic organism and of producing an immunity when animals were treated with it for a considerable length of time. An exudate obtained in this way from guinea pigs inoculated with fowl cholera did not cause an increase in the virulence of the organism. An immunity was brought about, however, by treating the animal with the pathogenic organisms after they had been killed by subjection to a temperature of 44° C. The active principle in suspensions thus obtained was found to be connected with the bacterial bodies since, when these suspensions were filtered, the material free from bacteria had no effect.

Chicken pox or sore head in poultry, C. A. CARY (*Alabama College Sta. Bul. 136, pp. 17-56, pls. 3*).—Chicken pox is said to cause more mortality among chickens in Alabama than any other disease. There appears to be no well-marked distinction between chicken pox, avian diphtheria, and roup, as these terms are ordinarily used. The literature relating to the subject is carefully reviewed. A number of inoculation tests were made with organisms obtained from cases of chicken pox.

The author concludes that the cause of the disease is not definitely known. Some evidence is usually presented to show that *Bacillus cacosmus* or some species of Bacterium or Pseudomonas may be factors in causing the disease, but careful experiments failed to connect either one of them with the disease as the primary cause. Chicken pox may be carried by various insects. The period of incubation varies from 2 to 20 days. Chicks from 7 to 8 months of age are most susceptible, and affected birds may recover in from 2 to 8 weeks. Mortality varies from 50 to 70 per cent.

The author reports satisfactory results from the application of iodoform and tannic or boric acid upon affected parts of the throat and eyes. A large number of other antiseptics have been used with fair success. A bibliography of the subject is given and mention is made of the chief points to be observed in the sanitary management of fowls.

A remedy for gapes in fowls (*Jour. Bd. Agr.* [*London*], *13 (1906), No. 6, p. 368*).—Success is reported in treating gapes by the fumes of carbolic acid. In

using this remedy the chicks to be treated may be placed in a basket over a pail containing carbolic acid in which a hot brick is placed for the purpose of volatilizing the acid.

Contagious epithelioma of fowls, E. Burnet (*Ann. Inst. Pasteur, 20 (1906), No. 9, pp. 742–765*).—According to the author's observations there is no necessity of supposing an intermediate host, such as flies, fleas, and other parasites for the micro-organism of contagious epithelioma in birds. The cellular inclusions observed in cases of this disease and frequently described as parasites do not pass through filters and therefore can not be considered as the true cause of the disease, since filtered virus is infectious. By the use of an attenuated virus a slight immunity to the disease may be produced.

Spirochæta in chickens, S. von Prowazek (*Arb. K. Gsndhtsamt., 23 (1906), No. 2, pp. 554–569, pls. 2*).—The spirochæta which most commonly affects fowls, causing spirillosis, appears in the blood within 2 days after inoculation and is most numerous on the fourth or fifth day. The spleen becomes enlarged and violet-red in color and the liver shows necrotic areas. An organism of this group is described as new under the name *Spirochæta anodontæ*.

Poultry parasites, C. M. G. Johnston (*Orange River Colony Dept. Agr. Bul. 12, pp. 15, figs. 5*).—Brief accounts are given of fowl tick, fowl mite, scaly legs, gape worm, and roup. These appear to be the most serious fowl diseases in Orange River Colony, and brief directions are given for their effective treatment.

An epizootic outbreak of tapeworms in pheasants, U. Caparini (*Clin. Vet. [Milan], 29 (1906), No. 36, pp. 872–877*).—In a serious infestation of pheasants with tapeworms the author found that the trouble was due to one species of tapeworm which assumes a number of forms quite different in appearance. The biology and morphology of this tapeworm was studied, but no practical suggestions were made regarding the control of the disease.

RURAL ENGINEERING.

Contributions to the knowledge of irrigation in the United States of America, Krüger (*Arb. Deut. Landw. Gesell., 1906, No. 119, pp. 60+7, pls. 21, figs. 27*).—This report is the result of a tour of investigation made by Engineer Krüger through the United States in 1904 for the purpose of studying irrigation conditions and methods in the arid West. The itinerary included Colorado, Utah, Nevada, California, Arizona, and New Mexico. Particular attention was given to the construction of canals and reservoirs, in which it is reported that little of novelty, aside from the temporary and unsubstantial character of the work, is to be seen.

From his studies the writer concludes that little can be learned by the German agriculturist from American irrigation methods, because of differences in climatic and economic conditions as well as the fact that German irrigation is for the purpose of supplying the soil with fertilizing ingredients rather than moisture. The writer also thinks it would be quite unwise to build structures in a country as thickly pouplated as Germany of such insecure and flimsy construction as are found in the western United States. For the German colonies, however, where arid conditions exist and where the population is relatively thin, the writer considers that the application of improved western practices and institutions would be eminently advisable. He recommends the enactment of a law for these colonies similar in operation to our reclamation law, a fund being provided by the government for the construction of irrigation works, the

cost of which would be returned to the government by those settling upon the tracts reclaimed.

Official proceedings of the Fourteenth National Irrigation Congress, held at Boise, Idaho, September 3–8, 1906 (*Proc. Nat. Irrig. Cong., 14 (1906), pp. 280, pls. 40*).—A report of the proceedings of the congress held at Boise, Idaho, Sept. 3–8, 1906, containing the various papers presented, the discussions upon the same, and the resolutions passed.

Closing the break of the Colorado River into the Salton Sink, southern California, H. T. CORY (*Engin. News, 56 (1906), No. 26, pp. 671–674, figs. 3*).—The author reviews the causes leading to the original break and describes the several unsuccessful attempts which have since been made to close the crevasse in the river bank and thus prevent the inundation of a large body of irrigable land in Imperial Valley. Unless the crevasse can be closed at once the course of the river will be permanently altered, and a greater geographical change will occur than has ever before been effected by human agency.

Raising of water by compressed air at Preesall, Lancashire (*Engin. Rec., 54 (1906), No. 9, pp. 243–245*).—In this article, transcribed from a paper written by James Kelly and published by the Institution of Civil Engineers, some experiments are described in the operation of air lifts. The water-bearing strata were found at a depth of 80 to 100 ft. below the surface. The compressed-air system was adopted, owing to the low yield from any one well and the necessity, therefore, of raising water over a considerable area, together with the desirability of having a system which would present a minimum possibility of breakdown—an important consideration in view of the appreciable amount of sand in the water, which speedily ruined the valves and working parts of a mechanical lift originally used.

Several conclusions were deduced from the experiments, as follows:

(1) That it was futile to attempt to force the output of a well, the best efficiency being obtained at comparatively low rates of working.

(2) The volume of free air used per cubic foot of water raised varied between 3 and 12 cu. ft., the lesser volumes being for the lower rates of working.

(3) The efficiency based upon the ratio of work done in raising water to the indicated work of the air cylinders varies between 20 and 40 per cent, being dependent upon the ratio of depth of submersion of the air pipe to the height of delivery (a ratio of 1.5 to 1 being the best), as well as upon the relative size of air pipe and well tube, and upon the rate of working, the lower rates of working giving the higher efficiency.

(4) The best results were attained by keeping the velocity of air and water combined at about 12 ft. per second at the point of entrance to the delivery pipe.

(5) The size of the delivery pipe should gradually increase in diameter from the bottom of the well to the surface.

Brief notes on absorption losses on canals, etc., [R. G. KENNEDY] ([*Proc.*] *Irrig. Conf., Simla, 1904, I, pp. 57, 58*).—The writer prefers to express absorption losses as so many cubic feet per second per million square feet of surface area of water, since it is claimed that it is a needless requirement to take wetted perimeters instead of surface because, while seepage varies as the former, evaporation which is included in all such data varies as the latter and the depth enters into the equation in an unknown degree.

Absorption losses on canals.

	Particulars.	Loss in cusecs per million square feet of water surface.		
		Minimum.	Maximum.	Average.
	On Bari Doab Canal—Good soil generally.			
Main line	Discharge about 4,000 cusecs, depth about 6 ft., all in shingle and sandy soil.	....	....	9.7
Branches	Discharges from 1,000 to 3,000 cusecs, soil good loam not sandy, with silted berms, but no fine silt on bed.	....	....	2.2
Distributaries ...	Discharges 30 to 100 cusecs, good loam soil, silted side berms and in lower reaches, fine silt on bed.	2.3	4.4	3.3
Water courses ...	Discharges 0.50 to 3.0 cusecs, good loam soil, generally rough bed and banks, in all sorts of conditions, some new.	3.3	30.0	9.4
On fields.........	When first water is laid on, sometimes soil was moist and in some cases quite dry.	5.5	16.0	8.0
	On Sirhind Canal—Sandy soil generally.			
Main line........ (First 26 miles.)	Discharge about 4,000 cusecs, depth about 7 ft., all in sandy soil, no shingle, sand, silted bed, and no side berms. The subsoil water table was close to surface and sloping away to the river from the canal at a grade of 2.4 ft. in 1,000.	....	....	9.0
Branches	Discharges from 2,000 to 4,000 cusecs, depth about 7 ft., all sandy soil, little or no side berms, and sand on bed.	....	....	5.2
Distributaries ...	Discharges 30 to 100 cusecs, all sandy soil, in all sorts of conditions as to bed and berms.	(5.0)	(12.0)	(8.0)
Water courses ...	Discharges 0.50 to 3.0 cusecs, all sandy soil in all sorts of repair.	(7.0)	(60.0)	(22.0)
On fields.........	When water is first laid on	(12.0)	40.0	(21.0)

Earthen dams, [A. HILL] ([*Proc.*] *Irrig. Conf., Simla, 1904, I, pp. 59–62*).—Considerable information is given relating to the subject in general, and certain opinions drawn from the experience of the writer are given in the following notes:

"The cross section of the bank should be proportionate to the depth of water, and the slope from the point where the full supply level touches the bank to the outer toe should be not less than 4 to 1 for banks of ordinary construction in less than 40 ft. depth of water. This line is the hydraulic gradient for the bank.

"The earth in the bank will become saturated in time, and in high banks the lower part will move and slip under the pressure of the upper portion and water, unless held down by some material not affected by water.

"For depths of water greater than 40 ft. the behavior of the bank when saturated is uncertain, and the cross section must be greater than for a bank of less depth.

"Up to 40 ft. depth the section recommended by the author has a core of selected water-tight earth 10 ft. wide at highest flood level, and with side slopes $1\frac{1}{2}$ to 1 on both sides. This core is to be protected on the top and water side by material not likely to slip when wet, like the soft moorum of decomposed rock of the Deccan, and the slope on the water face may be $2\frac{1}{2}$ to 1 or 3 to 1.

"The water-tight core should be covered on the rear slope by a mass of material not affected by water, and, to keep the earth from being forced into the drainage material, it should be arranged like a filter, with soft moorum on the inside against the earth core and large coarse material on the outer side, broken metal or screened gravel being very suitable for the outside.

"At the rear toe provision must be made for the water to escape, and the toe must be a mass of dry stone when the foundations are good.

"The best foundation for the rear toe of a bank is porous rock like moorum,

or rock, and the whole of the rear mass of drainage should be carried down to such rock when it is within reasonable depth.

"When no such moorum or rock is available then the site is not desirable, but if a bank has to be built a large trench should be excavated beneath the rear toe and filled with good drainage material and a berm formed over it.

"If a masonry core wall be used in an earthen dam it must be supported by earth backing to enable it to resist the thrust of the saturated material on the upstream side of the wall.

"If the cross sections of all sorts of embankments be studied, from that of a small watercourse up to a small tank embankment with 40 ft. depth of water, it will be found that in all cases where the bank is thoroughly satisfactory the hydraulic gradient through the bank is not less than 4 to 1; the hydraulic gradient is the slope from the point where the water touches the bank to the rear toe, and is the maximum gradient available for driving the water through the bank."

Land drainage, A. R. WHITSON and E. R. JONES (*Wisconsin Sta. Bul. 138, pp. 40, figs. 15*).—The authors include a compilation of data sufficient to enable the design of an open ditch or tile drainage system, and describe in detail several examples of the successful application of drainage in Wisconsin, citing the benefits which have accrued in each case. The practical operations necessary in the construction of tile drains are discussed, and various details of construction are described and illustrated. A brief synopsis of the Wisconsin drainage laws is followed by a discussion of the distribution of benefits, and the bulletin is concluded by an appendix on the description and use of instruments used in making drainage surveys.

The best value of Kutter's "N" to adopt in canal design, [R. G. KENNEDY] (*[Proc.] Irrig. Conf., Simla, 1904, I, p. 175*).—In discussing the question the author admits that the values of N worked out from time to time from observed canal discharges vary greatly for the same channel and even for the same site. Sufficient observations have, however, been made to fix N for Indian canals within fairly narrow limits. "On a quite new and well-dressed channel N goes down to 0.020, but with the bed silted and the banks fairly well kept, N is fairly steady at 0.0225 and ought to be adopted as an all-round figure in canal design."

In the discussions on this subject at the same conference the consensus of opinion seemed to be "that for distributaries or not very large canals, 0.0225 is the right value to assume, and for very large canals, 0.020 may safely be taken." One instance was cited where with a discharge of 1,200 to 1,500 cu. ft. per second the coefficient was found to be 0.016 to 0.017; in another case where the bed width was 250 ft., the depth 9.5 ft., and the discharge 8,320 cu. ft. per second the coefficient was found to be 0.018.

Industrial alcohol: Sources and manufacture, H. W. WILEY (*U. S. Dept. Agr., Farmers' Bul. 268, pp. 45, figs. 10*).—This bulletin is prepared in response to the general demand for information on the manufacture and use of industrial alcohol. The law under which this product may be manufactured occupies the first few pages of the bulletin, after which some extracts are given from the rulings of the Commissioner of Internal Revenue relative to the restrictions surrounding the production of denatured alcohol.

The substances used in its manufacture and denaturation are named and discussed. In this connection the suitability of several plants, such as artichokes, bananas, barley, cassava, potatoes, rice, speltz, and sweet potatoes for use in alcohol production are considered in some detail, tables being given of the usual starch or fermentable content of each. The comparative value of potatoes and other root crops for making alcohol is shown by the following

table, in which is given the percentage by weight of fermentable matter contained in each plant:

	Per cent.
White turnips	6 to 8
Rutabagas	8 to 13
Mangel-wurzels	8 to 15
Carrots	8 to 16
Parsnips	8 to 17
Sugar beets	10 to 22
Potatoes, sweet potatoes, and yams	14 to 26

The subject of the use of waste material or by-products receives attention, in which connection the possible value of cornstalks, molasses, wood pulp, sawdust, cannery wastes, etc., is considered. The manufacture of alcohol from such materials is not in general considered profitable, due to the fact that with some materials the season of supply would be too short, while in other cases the amount of alcohol obtainable is so small as to make production unprofitable unless the waste material could be utilized in distilleries already established.

The processes involved in the manufacture of alcohol are described and the apparatus illustrated, the bulletin being closed by conclusions in which the author draws attention to the fact that under the revenue regulations "the farmer must be content with producing raw materials and that he can not look forward to becoming a practical distiller."

It is further stated that "of the raw materials which can be utilized for the manufacture of alcohol, Indian corn is by far the most abundant and most promising source at the present time. The average price of potatoes must be very much decreased before raw material of this kind can come into competition with Indian corn as a source of alcohol." The benefits of the new law are stated to have probably been overestimated by the people at large, and it is suggested that it may be some time before the use of industrial alcohol in this country reaches the figure already attained by European countries.

Industrial alcohol: Uses and statistics, H. W. WILEY (*U. S. Dept. Agr., Farmers' Bul. 269, pp. 29, figs. 10*).—This bulletin supplements Farmers' Bulletin 268, and takes up largely the question of the utilization of denatured alcohol. Alcohol stoves and lamps are briefly described, with illustrations, and some information is given on the use of the alcohol motor.

The uses of denatured alcohol not directly entering into farm operations are enumerated and briefly discussed. Among these uses are included the manufacture of coal-tar dyes, smokeless powder, varnishes, ether, pharmaceutical preparations, imitation silk, artificial vinegar, and flavoring extracts.

The bulletin is concluded by tables giving statistics which show the magnitude of the distillery industry in each of the several States of the United States, together with some information on the consumption of alcohol and on the denaturing ingredients used in European countries.

Modern conveniences for the farm home, ELMINA T. WILSON (*U. S. Dept. Agr., Farmers' Bul. 270, pp. 48, figs. 26*).—The object of this bulletin is to suggest means and methods by which the household labor, now a hardship on many farms, may be lightened and the comforts, conveniences, and sanitary cleanliness of city life may be introduced into rural communities.

The question of water supply is first taken up and some suggestions are given for the proper location of wells, together with the methods of storing water by cisterns, elevated and pneumatic tanks, and the use of hydraulic rams, windmills, and gas or hot-air engines for the development of the water supply.

The house itself is next considered, hints being given on its proper location and on the building of the foundation and cellar. The arrangement of the

plumbing and the various kitchen and bathroom fixtures is explained in detail. Sewage disposal receives attention, various methods of collecting and disposing of liquid and solid wastes being described and illustrated. The heating system of the house is described with special reference to the use of the hot-air furnace and the size and location of air-distributing pipes. Following this are cited several examples of homes where modern conveniences have been installed, the character and cost of the improvements being noted and plans given of typical houses and grounds and of the water and sewerage systems.

RURAL ECONOMICS.

The cost of producing farm products, W. M. HAYS and E. C. PARKER (*U. S. Dept. Agr., Bur. Statis. Bul. 48, pp. 90, pls. 4, figs. 11; Minnesota Sta. Bul. 97, pp. 90, pls. 4, figs. 11*).—These bulletins report the results of investigations by the Bureau of Statistics, in cooperation with the division of agriculture of the Minnesota Agricultural Experiment Station, relating to the cost of producing farm products and giving methods devised in successfully inaugurating these studies.

Several farms in 3 counties of the State, where diversified and grain farming is conducted, were selected for the purpose of this inquiry, and detailed statistical data bearing upon every phase of the cost of producing crops are reported for the years 1902, 1903, and 1904. The objects sought relate in general not only to the economic side of the agricultural industry, such as securing profitable returns for labor, invested capital, managing ability, etc., but to the broader problems of farm management and organization, of providing practical data for use in agricultural schools and colleges, and of "developing a literature on farm management and a class of effective teachers, editors, and general writers."

In commenting on the value of the data secured in this investigation to the future welfare of agriculture, the authors conclude as follows:

"Statistics on the cost of production and concerning the general business of the farm, gathered under the methods here employed, together with data from plat experiments with crop rotations, from plat and laboratory experiments with fertilizers, from physical studies of the soil, and from the general practical experiences of proficient farm managers must be secured and made the common knowledge of our farmers if the farms of the United States are to be so planned and reorganized as to yield profits commensurate with the rapid appreciation of land values that is bound to follow the increase of population and wealth in the United States."

Condition of farm labor in California, W. V. STAFFORD and J. M. ESHLEMAN (*Bien. Rpt. Bur. Labor Statis. Cal., 12 (1905–6), pp. 72–81*).—Data secured by direct inquiry and by correspondence regarding the conditions of farm life and the wages of farm labor in California are reported.

Attention is called to the scarcity of reliable farm help, and the investigations center around the question as to whether or not the home life of farm laborers and the wages paid have any bearing on the problem of the scarcity of labor. The statistics presented relate to the classes of farms, number of white and oriental laborers, the conditions surrounding their home life, and the wages paid both with and without board, house rent, etc. Regarding the question under investigation the following conclusion is drawn:

"It is believed that this investigation shows conclusively the actual conditions prevailing in ranch work. The constant complaint, heard from every section of the State, of the scarcity of farm laborers, plainly indicates the necessity of some radical change in our present system. The encouragement of permanent

employees with families, to whom houses are furnished free, and the providing of baths, well-cared-for bunk houses, and improved table fare will certainly do much toward solving this problem, especially where the tendency is to cut up the large holdings."

The land system of New Zealand, S. P. SMITH (*New Zeal. Off. Yearbook 1906, pp. 551–564*).—The distinguishing features of the present land system in New Zealand are discussed in this article, which includes notes on the acquisition of native lands by the government, the conditions under which the land is allotted to settlers, and the systems of land tenure.

The land system of New Zealand rests on "the principle of State ownership of the soil, with a perpetual tenancy in the occupier. A very large proportion of the crown lands are now disposed of for 999 years. The rentals are based on the assessed value of the land at the time of disposal, without increase or recurring valuations. Under this system there is a fixity of tenure practically equal to freehold, and which, like freehold, necessarily carries with it the power of sale, sub-lease, mortgage, or disposition by will. At the same time the improvements made in the soil by cultivation, etc., are secured to the tenant should he from any cause be obliged to forfeit or surrender his lease."

Three modes of land tenure are recognized: (1) By purchase, in which one-fifth of the price is paid down at once and the remainder within 30 days, the final title not being given until specified improvements are made; (2) lease with a purchasing clause, at a 5-per-cent rental on the value of the land, the lease being for 25 years and carrying the right to purchase or to convert into a lease in perpetuity; and (3) "lease in perpetuity at a rental of 4 per cent on the capital value."

A digest of the land laws of New Zealand embracing the administration, classification, mode of acquisition and selection, improvement, and settlement of crown lands is included in the article.

Advances to settlers, S. P. SMITH (*New Zeal. Off. Yearbook 1906, pp. 564–573*).—This article treats of the plan adopted in 1894 by the New Zealand government "to afford relief to a numerous class of colonists who were struggling under the burden of high rates of interest and heavy legal expenses of mortgaging, etc." The plan consists in advancing sums of money ranging from £25 to £3,000, with interest "at the rate of 5 per cent, reducible to 4½ per cent provided payment is made not later than 14 days after due date and no arrears remaining outstanding." The successful working of the plan from its inception to the present time is shown by means of statistical data which are reported and discussed.

The indebtedness of peasant proprietors in Bavaria, A. COHEN (*Die Verschuldung des bäuerlichen Grundbesitzes in Bayern. Leipsic: Duncker & Humblot, 1906, pp. XIX+470*).—This volume is a contribution to the history of the development of agricultural credit in Bavaria, and treats particularly of the period between 1598 and 1745. The development of land ownership by the different classes of proprietors is described, the methods of transferring property are outlined, and the different forms of agricultural indebtedness are discussed in detail from the legal, social, and economic points of view.

Manual of world economics, edited by E. VON HALLE (*Die Weltwirtschaft, ein Jahr- und Lesebuch. Leipsic and Berlin: B. G. Teubner, 1906, pts. 1, pp. VIII+366; 2, pp. VI+253; 3, pp. VI+287*).—Part 1 of this publication contains an article on Agricultural Production by Wygodzinski, which gives statistics on the world's production of cereals and other staple crops, live stock, and sugar for 1905 and 1906, in comparison with preceding years. Statistics are also presented on the exports and imports of cereals for the years 1904 and 1905.

Part 2 contains an article on The Condition of Agriculture in Germany by C. Ballod, which gives statistics on cereal and crop production for the years 1896 to 1906, and discusses other economic topics of an agricultural nature as the indebtedness of farmers, land transfers, agricultural organizations, etc., in Germany.

Part 3 gives general economic and agricultural statistics for 1904 and 1905 of the other countries of Europe, of Japan and China, the United States, and several countries in South America.

Crop Reporter (*U. S. Dept. Agr., Bur. Statis. Crop Reporter, 8 (1906), No. 8, pp. 57–64; Sup., pp. 65–72*).—The December number contains in addition to the usual statistics on the condition of crops in the United States and foreign countries the following special articles: Ocean and inland rates on grain, December, 1906; agricultural products of Mexico; general hop situation; world's international trade in coffee; the grain shortage in Russia; the beet-sugar production of Europe; and other matters relating to agriculture. The supplement contains, in addition to the annual report of the Bureau of Statistics for the fiscal year 1905–6, special articles on stocks of American cheese, October 31, 1906; cotton growing in the German colonies; acreage, production, and value of the principal farm crops of the United States in 1906; cotton growing in British Central Africa, etc.

Agriculture in New Zealand, M. MURPHY (*New Zeal. Off. Yearbook 1906, pp. 374–386, 590–611*).—Statistical data on the acreage and yields of the principal cereal crops, root crops, grasses, etc., for the years 1905 and 1906, in comparison with preceding years, are reported and discussed.

In a special article the author describes the climate and agricultural advantages of New Zealand, shows the extent of land occupancy and the amount of public land still available for settlement, and reviews the outlook for farming in the cultivation of staple crops and the live-stock industry under New Zealand conditions. The prospects for the small farmer are said to be exceptional, owing to the humid climate and fertile soil of the country.

Martinique and Guadalupe, E. LÉGIER (*La Martinique et La Guadeloupe. Paris: A. Challamel, 1905, pp. 1–190, map 1*).—Chapters are devoted to the geography, geology, climatology, and flora of Martinique and Guadalupe, the prevailing economic conditions, together with legislation relating to the sugar industry, the culture, transportation, and sale of sugar cane and its profits, the production of sugar and its returns, the sugar factories, the production of rum and its costs and profits, the various crops of secondary importance grown in the islands, the future of the sugar industry, and to agricultural statistics.

Agricultural statistics, 1906 (*Bd. Agr. and Fisheries [London], Agr. Statis., 1906, pp. 89*).—This publication contains the returns of acreage under crops, grass, and fallow, and the number of live stock in each county of Great Britain for the year ended June 4, 1906.

AGRICULTURAL EDUCATION.

Federal legislation, regulations, and rulings affecting agricultural colleges and experiment stations (*U. S. Dept. Agr., Office Expt. Stas. Circ. 68, pp. 21*).—This circular includes the land-grant act of 1862, the act of 1866 extending the time within which agricultural colleges may be established, the Hatch Act of 1887, the Morrill Act of 1890, the Adams Act of 1906, excerpts from the act making appropriations for the U. S. Department of Agriculture for 1907, and regulations and rulings of the Post-Office Department, Treasury Department, and this Department concerning these various acts.

A four-year college course in agriculture (*U. S. Dept. Agr., Office Expt. Stas. Circ. 69, pp. 36*).—This is a summary of those reports of the committee on methods of teaching agriculture of the Association of American Agricultural Colleges and Experiment Stations which relate to college courses in agriculture. The circular includes syllabi of courses in agronomy, zootechny, agrotechny, rural engineering, and rural economics, and a discussion of the relation of natural sciences to agriculture in a four-year college course.

The advancement of agricultural education, E. J. WICKSON (*California Sta. Circ. 21, pp. 8*).

Benefits of agricultural education, E. A. BURNETT (*Ann. Rpt. Nebr. Bd. Agr., 1905, pp. 304–308*).—This is an estimate of the benefits to be derived from agricultural education based on present as compared with past conditions of the farmer. Among the factors considered are world-wide competition in agricultural products resulting from better transportation facilities, a wider knowledge of the relation of science to agriculture, changed methods of production, the demand for fancy products, knowledge of diseases and insect pests, instruction in schools of agriculture, and the social status of the rural class.

Developing the American farm boy, F. H. RANKIN (*Urbana: Univ. Illinois, 1906, pp. 18*).—This is an address given December 7, 1905, before the Northern Illinois Horticultural Society, and is concerned mainly with a discussion of the importance of education for country boys and the kind of education they should have. The function of the country school and of the college of agriculture in relation to the boys on the farm is pointed out, and an outline of the work of the Illinois College of Agriculture is given.

Rural education (*Seventh Conference of the Agricultural Societies of New Zealand, Wellington, 1905, pp. 34–39*).—This is a report of the special conference on rural education held July 19, 1905, in connection with the Seventh Conference of the Agricultural Societies of New Zealand. The Aukland Agricultural Society presented the following resolutions embodying the recommendations of a special committee of that society appointed to consider the organization of rural education in primary schools:

"That to be effective, the training for agricultural pursuits should commence in the primary schools, as it is there that the majority of the future farmers receive their education.

"That one of the first objects to be aimed at should be to provide for the special training of a certain number of teachers for the special work of rural education, by short courses of instruction, and by the appointment of traveling instructors for groups of schools to give object lessons explaining the value of school gardens and nature study, and to help and advise the teachers generally in carrying on instruction on these lines.

"That more should be attempted to bring the tuition in country schools into close relation with the practical work of the farm, so that the subjects taught should be directly connected with the work, surroundings, and after life of the pupils, the teaching being especially directed toward the development of their powers of observation, and toward giving them an insight into the fundamental principles which underlie the science of agriculture.

"That the best solution of the financial problem would be to try in certain centers, where local conditions make it possible, the plan that has already been adopted in Canada and the United States, of concentrating a number of small rural schools into one central school, and of providing free transportation of pupils thereto, thereby economizing finance and teaching power, and promoting greater efficiency of teaching, better classification of pupils, a higher grade of

instruction, the employment of better paid teachers, and a more complete equipment of school buildings."

The resolutions were fully discussed in conference, then unanimously adopted, and a committee appointed to present them to the premier.

Teaching agriculture in the common schools (*Ann. Rpt. Nebr. Bd. Agr., 1905, pp. 30–43*).—This report embodies the replies received by the secretary of the State Board of Agriculture of Nebraska to a circular letter sent to educational institutions in the State making inquiry concerning the nature and extent of instruction in agriculture given to teachers during 1905. Such instruction is given in the State University in a special 6 weeks' summer session for teachers, in the State Normal School at Peru during 18 weeks for all students, in the State Normal School at Kearney, in the Nebraska Normal College at Wayne in 50 recitations and 25 hours of experimental work, in the Fremont College at Fremont, 5 hours a week, in Grand Island College at Grand Island, 5 hours a week, in York College at York, 3 hours a week for one term, in the 5 State junior normal schools at Alliance, Holdrege, McCook, North Platte, and Valentine, and in about 50 high schools of the State which include normal courses in their work.

The report also contains a letter from the State Superintendent of Public Instruction, in which a review of progress made in teaching elementary agriculture in the public schools in 1905 is given. Among the features of this progress have been teachers' reading circle work in agriculture, summer school instruction in agriculture in the State junior normals, and normal training in agriculture in high schools.

School gardening has also received attention and much interest has been aroused by means of county and State corn growing and cooking contests carried on through 2 State organizations known as the Nebraska Boys' Agricultural Association and the Nebraska Girls' Domestic Science Association, as well as through a number of county associations of similar stamp.

The place of nature study, school gardens, and agriculture in our school system, J. R. Jewell (*Reprint from Pedag. Seminary, 13 (1906), pp. 273–292*).—The writer reviews briefly the progress in the introduction of nature study, school gardens, and agriculture into the public schools of this country, and comments on the importance of this work. He shows that the agricultural colleges have been largely engaged in preparing leaders in agricultural education and research, and that the preparation of an intelligent farm population must be taken up by schools of lower grade. The introduction of agriculture into these schools would, in his opinion, result in pupils remaining in school longer, as they have been done in France and Belgium, and he argues from figures of increased corn production in Iowa, increased income for bacon, butter, and eggs in Denmark, and for butter in Ontario that such instruction would result in material benefit to the farmers. He also argues that with the introduction of nature study, school gardens, and elementary agriculture, a better ethical condition among pupils would attain, as has been shown by reports from police officers and courts in New York, Philadelphia, Cleveland, and Dayton. He thinks that education along these lines would set the tide of population distinctly toward the country, help to solve the labor problem on he farm, and greatly enhance rural social conditions.

Progress of nature study in California, B. M. Davis (*Nature-Study Rev., 2 (1906), No. 8, pp. 257–265*).—The early history of the nature-study movement in California is outlined; also the more recent progress and tendencies of this movement and the factors and influences now contributing to the advancement of it. Among the more important of the factors mentioned are Stanford Uni-

versity, the University of California, the 5 State normal schools, and some notable examples of nature-study work and school gardening in the public schools of cities.

MISCELLANEOUS.

Nineteenth Annual Report of Illinois Station, 1906 (*Illinois Sta. Rpt. 1906, pp. 13*).—This contains a list of station publications, a brief statement concerning the principal lines of station work, and a detailed financial statement for the fiscal year ended June 30, 1906.

Nineteenth Annual Report of Indiana Station, 1906 (*Indiana Sta. Rpt. 1906, pp. 62*).—This contains the organization list, a report of the director on the work of the different departments of the station during the year, a list of station publications, notes on changes in the station staff, the text of the Adams' Act, with a brief discussion of it, an enumeration of some of the needs of the station, more or less detailed reports of the heads of departments, and a financial statement for the fiscal year ended June 30, 1906.

Twenty-fifth Annual Report of Ohio Station, 1906 (*Ohio Sta. Bul. 176, pp. XIX*).—This contains an announcement concerning the work of the station, the organization list and report of the board of control, a financial statement for the fiscal year ended June 30, 1906, and a report of the director summarizing the work of the station during the year.

Fifteenth Annual Report of Utah Station, 1904 (*Utah Sta. Rpt. 1904, pp. 26*).—This includes the organization list of the station, a report of the director and departmental reports reviewing the different lines of station work during the year, and a financial statement for the fiscal year ending June 30, 1904.

Sixteenth Annual Report of Utah Station, 1905 (*Utah Sta. Rpt. 1905, pp. XXIV*).—This is similar in scope to the above report.

Report of committee on experiment station organization and policy (*U. S. Dept. Agr., Office Expt. Stas. Circ. 71, pp. 7*).—Reference has already been made in this report (E. S. R., 18, p. 411).

Publications of the Office of Experiment Stations from its organization to June 30, 1906 (*U. S. Dept. Agr., Office Expt. Stas. Circ. 70, pp. 12*).

Press bulletins (*Ohio Sta. Bul. 176, pp. 400–407*).—Reprints of press bulletins on the following subjects: Wheat midge or "red weevil;" late blight or rot of potatoes; how to fight grasshoppers; fertilizing the wheat crop; profitable farm forestry; beware of impurities in clover and alfalfa seeds; misrepresentations of tree agents; injuries to trees by mice and rabbits; old tobacco plant beds v. new ones, and what is the condition of your seed corn.

A visitors' guide to the more important features of the station's work in 1906 (*Ohio Sta. Circ. 56, pp. 14, figs. 10, map 1*).

Index for Bulletins 48–68 of the North Dakota Station (*North Dakota Sta. Index Buls. 48–68, pp. 13*).

NOTES.

Florida Station.—F. M. Stearns, for two years past gardener, died February 6.

Georgia College and Station.—A series of farmers' institute lectures was given jointly by the college and station along the line of the Georgia Coast and Piedmont Railroad, from February 6 to 10, the railroad providing a special car and bearing all expenses of the trip. Meetings were held at the court-houses and schoolhouses of a number of towns in the southeastern part of the State. The audiences ranged from 60 to 200 at each session. The lecturers were Harvie Jordan, director of farmers' institutes; J. S. Stewart and J. M. Johnson, of the university; R. I. Smith, State entomologist, and C. L. Willoughby, of the station. This is the first movement of the sort in Georgia, but its success is such as to make probable the continuation of the movement.

Cornell University.—The dairy building, which will eventually form one wing of the large agricultural building in course of erection for the college of agriculture, is the first of the group to be completed and is now in use. It consists of a 2-story and basement brick structure, 101 by 51 ft., to be used solely for classroom, office, and laboratory work, and a 1-story and basement wing, 163 by 60 ft., in which are located all the machinery and apparatus for the manufacture of dairy products. In this way the noise, vibration, and dampness incident to butter and cheese making do not interfere with other work.

In the manufacturing rooms much attention has been given to sanitary requirements. Wherever possible brick, cement, iron, and tile have been used instead of wood. To prevent the lodging of dust, door and window frames and baseboards have been set flush with the side walls, and doors have been made smooth and without panels. All shelving is detachable, resting on iron brackets secured by bolts. Side walls are of cement or hard finish, and floors of cement or tile. The latter is used in the butter and cheese making rooms, where special precautions have been taken to secure thorough cleansing and drainage. All rooms are profusely lighted, and the manufacturing rooms are equipped with shades which can be as easily laundered as towels.

Steam for heating and cleansing is obtained from the main agricultural building, and power from a boiler and engine at the extreme end of the wing, to permit of instruction in the management and care of this machinery. Modern appliances have been provided throughout, including a complete outfit for the study of problems in handling market milk, manufacture of Roquefort, Camembert, and other fancy cheeses, dairy mechanics, etc. The main portion of the building contains a museum, reading room, bacteriological and milk-testing laboratories, and all necessary facilities for instruction and research work.

Pennsylvania College and Station.—A four-year undergraduate course in forestry has been established, and Dr. B. E. Fernow has been placed in charge of this work. An assistant professor of forestry is to be appointed, and a new building for the department is projected. Other appointments have been made as follows: Alva Agee, professor of agricultural extension; Charles F. Shaw, instructor in agronomy; Joseph E. Dunipace, assistant in agricultural chemistry, and Ralph Martin, assistant in dairy husbandry.

In the station W. H. McIntire has been appointed assistant in animal nutrition, to succeed N. C. Hamner, who has accepted the position of assistant chemist at the Texas Station. Bailey E. Brown, of the Bureau of Soils, has been appointed assistant professor of experimental agronomy; C. L. Cook and F. R. Reid, of the same bureau, soil experts; J. F. Barron, assistant in experimental agronomy; Arthur W. Broomell and G. C. Given, assistant chemists, and E. F. Fortin, traveling dairy expert.

A soil survey of Center County, in which the station is located, is to be made by the Bureau of Soils.

Rhode Island Station.—W. F. Purrington has resigned as assistant chemist to accept a position in a food laboratory in New Hampshire.

Land-grant Colleges to be made Depositories of Public Documents.—In a supplemental report of the Joint Printing Investigation Commission of the two Houses of Congress it was recommended that the land-grant colleges be designated depositories for all public documents. A bill providing for such distribution was passed by the Congress just closed. This is one of the ends which has been sought by these institutions. Under this measure all Government publications will be sent regularly as issued, instead of requiring special application to Members of Congress, as in most cases at present.

Eulogies on Hon. H. C. Adams.—At a memorial session of the House of Representatives on February 24, tributes to the life and services of Hon. H. C. Adams, of Wisconsin, were paid by his late colleagues. Many appreciative addresses were delivered, which brought out the high regard and the affection in which Mr. Adams was held, his strength in the halls of Congress, and his services in behalf of American agriculture especially.

Referring to the act which bears his name, Representative Esch, of Wisconsin, said: "Realizing the valuable work of the various agricultural experiment stations of the United States, and that with an increase of funds at their disposal this work could be largely increased, he at once introduced a bill with this end in view. Nothing more finely illustrated a distinctive trait of Mr. Adams's character as to fixity of purpose and indomitable will than the patient courageous, and splendid fight he made for his bill. After the lapse of many weeks and months he won. He deserved to win, and as a result his memory lives in the chief seats of learning of almost every State in the Union."

Representative Lever, of South Carolina, called attention to Mr. Adams's remarkable insight into agricultural porblems and his faith in the coming of ideal farm conditions. "It was this enthusiasm, this belief that a good fight for a worthy cause could not fail, which induced him to introduce and fight through Congress a bill doubling the appropriation to the State experiment stations of the country. Who can forget the earnestness, the vigor, the persistency, the tenacity which marked his efforts in this behalf? Nothing could daunt him, nothing could stem the tide of his enthusiasm. The opposition was brushed aside by the justness of his cause and by the eloquence and earnestness with which he presented it, and this one act, this one supreme and triumphant effort in behalf of the American farmer, is sufficient to make Henry C. Adams one of the splendid characters of our history. And when agriculture receives that recognition to which she is entitled, when our farmhouses are filled with educated and happy occupants, and when ideal conditions have been reached, his name will be revered along with that of Morrill and Hatch. Can any higher tribute be paid to any man than to give him equal rank with those men in our history who have wrought most effectively and wisely for the greatest industry of the nation?"

American Breeders' Association.—The third annual meeting of this association was held at Columbus, Ohio, January 15–18, 1907, in conjunction with

meetings of the Ohio State Board of Agriculture and twelve other agricultural organizations of that State. One of the principal features of this meeting was the reports of committees appointed to consider different lines of breeding and to devise ways and means of promoting them. These and the more important addresses and papers presented are noted below.

The association passed resolutions (1) urging upon Congress and the legislatures of the various States a continuation of their liberal policy in the building up of education and research in agriculture, including that relating to the production and improvement of plants and animals; (2) requesting Congress to devote the money now appropriated for the free distribution of seeds to the importation and improvement of plants; (3) requesting such modifications of the game laws of the different States as will permit the capture and shipment of game birds for purposes of propagation; (4) authorizing the committee on eugenics to organize as a committee of the association or as an independent society, and (5) directing the secretary of the association to ascertain the desirability of increasing the annual dues from $1 to $2, and the feasibility of publishing a monthly journal devoted to the interests and objects of the association.

Francis Galton, of England, was elected an honorary member of the association. The retiring officers were reelected with the exception of the secretary of the animal section, which office will be filled during the coming year by C. B. Davenport, of Cold Spring Harbor, N. Y. Preference was expressed for Washington, D. C., as the next meeting place.

Papers and addresses.—In an evening address before the general assembly, W. M. Hays discussed the subject of Education in Breeding. He urged the establishment of agricultural high schools in farming districts, and schools for mechanic arts and home economics in cities, which could be effectively accomplished by appropriations amounting to 20 cents per capita. In this connection reference was made to the recent progress along this line in Georgia. The consolidation of rural schools and the establishment of agricultural high schools were considered necessary steps in making available to the people the results of agricultural research, for which liberal appropriations are now being made. With a system of agricultural instruction extending from the university to the consolidated rural school, it was considered possible to have centers for animal and plant breeding at the State station and branch stations. The work of a plant-breeding station which has been in existence in Minnesota for 15 years was illustrated by means of moving pictures.

One of the most interesting features of the meeting was an address on Breeding Cattelo, by C. J. Jones. The catteio is a cross between the buffalo and domesticated cattle. Much progress has been made in breeding the cattelo, as also in crossing mountain and domesticated sheep. This work, originating with the speaker, will henceforth be carried on in cooperation with this Department. Much information was also given concerning the buffalo in its wild state and of the efforts being made to preserve the species.

Breeding Beef Cattle in Ohio was discussed by J. P. Hine. The speaker objected to the great difference in market prices between heifers and steers, stating that this difference, amounting in some instances to $2 per hundredweight, is the greatest imposition the beef producer has to contend with. It was noted that this discrimination between sexes is no longer made in Great Britain.

A paper on Breeding Dairy Cattle, by M. A. Scovell, dealt mainly with the history of the Jersey breed. It was suggested that efforts for the further improvement of this breed should be along the lines of constitutional vigor and yield of milk.

C. W. Gay discussed The Breeding of the American Harness Horse. There is, according to the speaker, a growing demand for this type of horse, which is now produced by chance. Utilizing the American breeds for the production of this type of horse, the speaker suggested keeping on the top cross a standard-bred sire of the heavy harness type and using for dams mares of the American saddle or preferably of the Morgan breeds. Going outside of native breeds, the speaker would suggest the use of an English hackney dam.

The Teaching of Animal Selection or Animal Judging was discussed by C. S. Plumb. Methods of teaching animal judging to students in agricultural colleges were briefly presented.

R. H. Johnson, in discussing the subject What the Poultry Breeder Can Learn from the Cattle Breeder, compared the two lines of animal breeding as regards (1) quality of stock, (2) selection, (3) competitive shows, (4) performance records, (5) centgener power, and (6) performance tests. In many respects the poultry breeders were shown to be behind the cattle breeders. Special emphasis was laid upon performance contests. The speaker was in favor of securing individual records, of making the competition one between individuals and strains rather than breeds, and of instituting contests in which not only egg records but gain in weight in proportion to food consumed should be taken into account.

C. B. Davenport addressed the association on The Inheritance of Pedigree Breeding in Poultry. The different forms of inheritance recognizable in hybridization were stated as follows: (1) Inheritance is alternative, i. e., one of the two contrasted conditions of a given organ is dominant over the other and alone appears in the progeny; (2) inheritance is particulate, i. e., both of the contrasted characters appear in the offspring side by side in a patchwork; (3) inheritance is blending, i. e., the opposed characters being quantitatively unlike, the offspring are approximately intermediate between the two parents; and (4) inheritance is neomorphic, i. e., a characteristic appears in the hybrids that can not be seen in the parents. In illustrating these laws the speaker considered various characters, such as color of plumage, form of comb, etc., in hybrids.

The processes necessary for the creation of a new race which shall combine various desirable characters found in two or more races were summarized by the speaker as follows: (1) Hybridization by which the desired combination may be obtained at least in the second hybrid generation; (2) purification of the race by the elimination of germ cells carrying the characteristics that are opposed to those sought; and (3) selection of the best breeding individuals as parents, by which there will be obtained a larger percentage of offspring of the best quality. This work of obtaining and fixing a desirable characteristic will, of course, be hastened if there can be found some individual which is prepotent in respect to that characteristic.

In discussing The Production and Fixation of New Breeds, W. E. Castle gave the results of extended investigations in crossing rats. The variation following crossing was considered due largely to the production of new combinations of unit characters. Such combinations may be fixed by selection. Inbreeding is not essential. No fixation is required when crossing results in a blend rather than in alternative inheritance.

In summarizing the results of his experiments, the speaker stated that where Mendelian inheritance is involved new characters are produced by cross breeding by the forming of a mosaic differing from either parent, or by the becoming visible of an element previously invisible in one of the parents. The fixation of the new character will consist in securing gametes which separately contain all the factors necessary for the production of the new character. When the

characters are previously separated complete fixation may be secured in two generations. When the new character is a mosaic a longer time is required, as gametic contamination which is non-Mendelian in character is involved.

Rejuvenation by Hybridization was the subject of an address by Q. I. Simpson. The vigor or energy of offspring, according to the speaker, is affected by four factors—hybridization, crossing, change of nutrition, and change of climate. These factors were explained and illustrated in connection with a discussion of the author's theory of "cell polarity," which has to do with the origin and function of centrosomes.

G. M. Rommel discussed The Inheritance of the Size of Litter in Poland China Sows. Brief reference was made to the results of studies reported in Circular 95 of the Bureau of Animal Industry (E. S. R., 18, p. 267). More recent studies of the inheritance of the size of litters from mother to daughter were reported. The later results showed that the size of the litter increases with the age of the sows from 1 to 5 years. The results also showed a tendency toward the transmission of the size of litter, this being most marked in the case of the youngest daughters.

E. C. Schroeder, in discussing Animal Breeding and Disease, stated that disease is a disqualifying condition in any animal from which the highest type of progeny is expected. This was illustrated by reference to specific diseases. Means of eradicating certain diseases, especially tuberculosis, were discussed. Special attention was called to the spreading of disease by the growing custom of stabling animals by classes in exhibitions instead of by owners. Among other topics discussed was the inheritance of susceptibility to disease. Tests carried on for ten years have shown that the susceptibility of hogs to hog cholera varies from an extremely high grade to absolute immunity. Great variation was also observed in the susceptibility of cattle to Texas fever and other diseases. Efforts are now being made to obtain a breed of hogs immune to cholera by breeding from naturally immune stock. Mention was also made of other lines of work similar in character in which the Bureau is engaged.

Corn Breeding and Registration was discussed by C. G. Williams, who considered the ear-row test the proper basis for this work. Ears for this test should be selected upon the growing plant in order that environment may be noted and the first step taken in sifting the inheritably good from the accidentally good. The ear-row test may be employed without regard to other cornfields. In order to overcome differences in environment this test should be made in duplicate, with uniform check rows at regular intervals. The value of this duplication was illustrated by the work of Ohio breeders.

One-third to one-half of the seed grain of each ear should be saved for use in the breeding plats when the test has demonstrated which the high-yielding ears are. The remnants of the high-yielding ears are crossed the year following the test, one being used as sire upon several detasseled dams. A plan for continuous corn-breeding work was presented in which inbreeding was thought to be provided against. Rules were given for the registration of pedigreed and merged strains of corn as adopted by the Ohio Plant Breeders' Association.

The breeding of tobacco with particular reference to the work of this Department was discussed by A. D. Shamel.

A review of Tobacco Breeding in Ohio was presented by A. D. Selby. The State has four tobacco districts in which characteristic and distinct varieties are grown. Efforts at crossing the Connecticut seed leaf with the Cuban seedleaf tobacco in the cigar-filler district have resulted in the production of 35 or more hybrids which are being tested. New wrapper tobacco hybrids have also been produced and are being subjected to tests.

W. H. Scherffius presented a report on Tobacco Breeding in Kentucky. Attention was called to the fact that Kentucky produces more than one-third of the output of tobacco of the United States, and fertilizer and variety tests were reported. White Burley tobacco has given better results than crosses of this variety with Connecticut, Havana, and Sumatra varieties. The protection of the seed heads from cross fertilization by bagging and the use of the seed separator have resulted in the production of better and more uniform crops.

C. W. Waid reported the Results of Hill Selection of Seed Potatoes. Seed was selected from high and low yielding hills and from hills resistant to disease, the work being carried on at the Ohio Station for three years. In general the results showed an increase in the yield of potatoes when the seed had been selected from high-yielding hills, and a decrease when the seed had been selected from low-yielding hills. The selection of seed from high-yielding hills is therefore recommended. Selection from hills showing resistance to early blight has given very encouraging results.

The Improvement of Sugar Cane by Selection and Breeding was discussed by C. O. Townsend. Several difficulties encountered in the improvement of sugar cane by vegetative selection or breeding were mentioned, such as confusion of names, nonstability of characters, and size and position of flowers. The principal points aimed at by cane breeders were enumerated and summed up in the statement that the cane most desired is the one that will yield the largest quantity of sugar per acre with the greatest certainty and the least expense. In the work already done much progress has been made in increasing the yield of cane and also the sugar content, in securing varieties more or less resistant to disease, and in developing varieties suited to different soil and climatic conditions. Improvement by seminal variation has so far given the most satisfactory results.

J. E. W. Tracy discussed Breeding of Sugar Beets to Increase the Sugar Content and Yield Per Acre and the Encouragement of the Sugar-beet-seed Industry in America. It was considered possible to increase the available sugar in sugar beets grown in the United States at least 2 per cent by the use of better seed, and also in the same manner to increase the yield of sugar beets per acre to a marked extent. Mention was made of the efforts being put forth in this country to establish pedigree strains of seed. Sugar-beet growers were urged to produce their own seed, in which work the Department of Agriculture is willing to cooperate.

In discussing the Breeding of Clover, S. M. Bain reported finding individual clover plants very resistant to disease.

A paper by F. Dorner, sr., on Carnation Breeding contained a brief history of the carnation, a description of methods employed in breeding, and an enumeration of the requirements of a good carnation. Breeding experiments have been carried on by the author since 1889. J. B. Norton described some experiments in breeding carnations carried on in the Department of Agriculture, illustrating his remarks with lantern slides showing the results of hybridization.

The Importance of the Mutation Theory in Practical Breeding was discussed by G. H. Shull. The speaker called attention to the large number of unexpected variations which have formed the starting point for the production of new strains, and mentioned the need of care in order to avoid confusion in distinguishing mutations from forms produced by hybridization. Mutations were considered the basis of every permanent seed strain. According to the speaker, the method of breeding in order to harmonize with the mutation theory should consist in the production of as large number as possible of seedlings among which to seek valuable mutations; as complete isolation of selected individuals as their breeding habits will permit and complete control of fertilization, and the rearing of the offspring under conditions that will allow all distinguishing

characteristics to reach a normal development. It was stated that these requirements are more or less closely approximated by the various isolation methods now in use.

S. M. Tracy showed by numerous illustrations The Importance of Securing Full and Accurate Descriptions of Varieties. The Press and Breeding was discussed by W. I. Chamberlain, mainly as regards the use of illustrations in advertising.

Papers read by title.—C. E. Woodruff submitted a paper entitled: The Prevention of Degeneration is the Only Practical Eugenics. The author maintained that a study of heredity will prove that defects are often due to remedial causes, and suggested that sanitation in its broadest sense is the only practical means for preventing degeneration.

The Evolution of the Bacon Hog in Ontario was set forth in a paper by J. Dryden. This was considered the highest achievement of the Ontario Department of Agriculture while under the guidance of the author. It was stated that the present high and uniform quality of bacon has been attained entirely by selection based on the killing tests. The animals reserved for breeding were selected to supply the same type which won first place in such tests. Close inbreeding was not resorted to.

A Plea for a More Extended Use of the System of Live Stock Registration was made in a paper by M. M. Boyd.

A paper by J. B. Norton discussed the methods of oat breeding, and mentioned results which have already been secured. The principal aim in the breeding of oats in the United States is that of resistance. Plants have already been obtained which are nearly free from smut and rust.

A paper on The Selection of Seed Corn, by C. D. Smith, contained the results of experimental work and suggestions concerning the best methods to be employed in the selection of seed corn.

Statistics of Cotton Variation were reported in a paper by N. D. Shoemaker. The study was undertaken to determine the gain in a desirable character which might be expected from the progeny of a single plant, and how this gain might be affected by cultivation and seasons. The results are interpreted as favoring the check-row system, making a large number of selections, and the keeping of fairly complete progeny records.

H. H. Groff called attention to certain results which have been secured by him in growing gladioli; and The Ease and Importance of Improving the Varieties of Cultivated Nuts was discussed in a paper by J. R. Smith.

A paper by N. E. Hansen entitled, A Plant Breeder's Trip to Eurasia gave notes on a journey around the world, made primarily for the purpose of tracing the northern limits of alfalfa in Asia. L. J. Briggs submitted a paper entitled Grading in Agricultural Judging Contests, in which a system of preparing grading tables was presented. Disseminating New Varieties of Plants, by C. W. Ward, was also read by title.

Reports of committees.—A verbal report on cooperation in animal breeding was submitted by W. M. Hays. Special mention was made of the project for the determination of the value of the dual purpose cow, as represented by the milking Shorthorns, now being carried out by the Minnesota Station in cooperation with the Department of Agriculture.

A verbal report on animal hybridization was submitted by W. J. Spillman. The committee has devised a system of keeping records for cross-bred animals intended for farmers and breeders generally. It has also undertaken to collect the literature relating to animal hybrids. Some results obtained by the application of scientific knowledge to animal breeding were noted, and the Mendelian law was discussed.

A report on breeding dairy cattle was submitted by A. J. Glover. This was in the nature of disconnected notes rather than a committee report. Among the subjects discussed were the importance of production as compared with conformation in judging dairy cattle, the value of short tests, the determination of prepotency, the relative weight of heart and lungs in dairy and beef cattle, and the effect of food on the health of cows and the quality of the milk.

A verbal report on breeding wild birds was submitted by T. L. Palmer. This subject was discussed as regards the importation of wild birds, raising wild birds in a state of nature, the breeding of wild birds in quantity under domestication, and the breeding of birds for a specific purpose, such as the crossing of wild and domestic turkeys in order to secure a race resistant to blackhead. Many instances of the importation of wild birds were mentioned, and the efforts being made to restore to some extent some of the birds now disappearing, such as the eider duck, were described. The speaker called attention to State legislation restricting the capture and shipment of wild birds as a serious difficulty in the way of breeding experiments.

A report on theoretical research in heredity was submitted by C. W. Ward. This consisted essentially of a review of recent advances in the theory of breeding, by C. B. Davenport, and an outline of some of the more important problems in theoretical research relating to heredity, by W. J. Spillman, both members of the committee. According to Doctor Davenport, the newer investigations are revealing certain laws accessory to or modifying Mendel's law. In the first place, Mendel's law of dominance is not universal as characters occasionally blend. Reversion, moreover, constitutes a special case of inheritance in hybridization and does not stand in opposition to the ordinary laws of inheritance. Unpublished data of the author indicate that account should be taken of the immediate characters of the parents as well as of their ancestry. Pure dominants, in the author's experience, can usually be distinguished from heterozygous dominants without resort to breeding tests. Subjects mentioned especially by Professor Spillman as deserving investigation are the relation of the extra chromosome to sex, the relation of chromosome to hereditary characters, and the correlation of characters.

A report on breeding cereals, by L. S. Klinck, dealt with the following subjects: (1) Search for foundation stocks, (2) method of starting foundation stocks, (3) selection, (4) distribution, (5) problems for the different cereals, and (6) crossing and hybridization. Under these headings the report summed up in a general way some of the problems that confront breeders of cereals. It was suggested, for instance, that comparative tests should be made of the centgener method and the row, drill, and Burbank methods in obtaining new foundation stocks. More investigation was considered necessary to determine whether the individual is the best basis for selection in all the various crops. It was considered desirable that more data should be secured on the best means of distributing improved seed. Some of the problems to be met by the breeder of wheat, oats, barley, rye, durum wheat, emmer, and corn, were enumerated, and it was suggested that each crop be assigned to a subcommittee for a fuller report.

A report on corn breeding, submitted by J. D. Funk, dealt with the value of the score card from the standpoint of the breeder, and the methods of breeding now employed. The mating of individual plants was suggested as a valuable supplement to the ear-row test.

The committee on breeding cotton, in a report read by title, stated that it was undertaking to investigate and standardize methods to be used in breeding this crop. It is the plan of the committee to present individual papers each year rather than a committee report. The paper presented at this meeting was by

the chairman, H. J. Webber, and dealt at length with methods of pedigree breeding recommended for use in breeding cotton.

Several other committee reports were read by title.

Dry Farming Congress.—The Trans-Missouri Dry Farming Congress was organized at Denver, January 24, with an attendance of about 300 delegates and over 700 visitors. A two-day session had been planned, but the interest manifested was such as to prolong the convention an additional day. Addresses were delivered by representatives of this Department and a number of the western agricultural colleges and experiment stations, Governor Buchtel of Colorado, and many others, on various aspects of dry farming, such as cultural methods, irrigation, stock raising, and related problems. Resolutions were adopted advocating the establishment of experimental and demonstration farms, and the distribution of accurate information by the National and State governments. Fisher Harris, of Utah, was elected president, and it was decided to hold the next convention at Salt Lake.

Botany and Agriculture in Ceylon.—The development of the Royal Botanic Gardens at Ceylon, their work for agriculture, and the establishment of experiment stations are described by Dr. J. C. Willis, director of the gardens, in a recent issue of *Science Progress* (1906, No. 2, pp. 308–324).

These gardens were established as early as 1810, and along with their systematic studies did a good deal of economic work under their early directors upon such plants as cinchona, tea, coffee, rubber, and cacao. During the last 10 years, the writer says, they "have grown entirely beyond the conception of botanic gardens, and have become practically a department of agriculture, though the name of 'botanic gardens' is still retained, and the work of purely botanic gardens is still carried on among many new lines of work." An entomologist was attached to the gardens in 1899, and a mycologist two years later. More recently a chemist has been appointed and laboratories provided.

The work of these specialists has brought about a complete change of attitude on the part of British planters, who had previously followed the plan of concealing any outbreak upon their plantations. "So far has opinion turned in the opposite direction from that which it formerly occupied, that the newspapers of Ceylon are now among the first to draw attention to any slight outbreak of disease, and to call for the help of the mycologist or the entomologist."

Two experiment stations have also been established where culture experiments are conducted on a larger scale, one in connection with the gardens at Peradeniya and the other at Maha-iluppalama. The former is in the "wet" zone of Ceylon and in the European planting districts. Its experiments are mainly with cacao, rubber, tea, citronella, and ground nuts, and with lemon grass as a possibly paying new product. It has 20 acres in tea, 15 acres in lemon grass, and other crops in proportion. The station at Maha-iluppalama "lies in the almost uninhabited 'dry' zone of Ceylon," and the experiments have been mainly with cotton, which they indicate may be made a crop of considerable value to Ceylon.

The work of the stations also extends to the mantenance of soil fertility, methods of harvesting various crops, preparation for market, etc. "Much valuable work has been done upon the different ways of preparing the best quality of marketable rubber, upon the best ways of distilling oil of citronella or of lemon grass, upon the best ways of fermenting and drying cacao, and similar problems." From being looked upon somewhat askance, the stations are now appreciated and looked to for aid, and "are beginning to foster that most desirable spirit among the planters, the experimental habit of mind."

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EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, Ph. D., *Assistant Director.*

EDITORIAL DEPARTMENTS.

Meteorology, Soils, and Fertilizers—W. H. Beal.
Agricultural Botany and Vegetable Pathology—W. H. Evans, Ph. D.
Field Crops—J. I. Schulte.
Horticulture and Forestry—E. J. Glasson.
Zootechny and Human Nutrition—C. F. Langworthy, Ph. D.
Agrotechny, Dairy Farming, and Dairying—H. W. Lawson.
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NOTE.—The publications of the United States Department of Agriculture, except those of the Weather Bureau, may be purchased from the Superintendent of Documents, Washington, D. C. For the publications of the Weather Bureau requests and remittances should be directed to the Chief of the Bureau. The price of the Record is $1 per volume, or 10 cents per number. The prices of other technical publications are given in the list above. The publications of the State experiment stations are distributed from the stations and not from the Department.

ILLUSTRATION.

EXPERIMENT STATION RECORD.

Vol. XVIII. April, 1907. No. 8.

The act making appropriation for the National Department of Agriculture is each year becoming a more important factor in the working out of public policy. The development of the Department has gradually led up to a variety of large national questions, and the consideration of the agricultural appropriation bill in Congress is made the occasion of extended discussion of these broad questions out of which a public policy relating to them is being developed. The bill frequently receives more attention than that for any other executive department, this attention being far out of proportion to the amount of money involved, although not to the importance of the subject matter itself. The greatly increased interest in agriculture in a national sense and in the Department's work has grown out of an increased realization of the importance of agriculture as a great basic industry, largely contributory to wealth, production, commerce, and other industries, and touching the interests and prosperity of the country and the people as a whole.

Last year the Federal meat inspection law was enlarged and greatly developed so as to place the Department in control of all meat products for interstate commerce and for export, and of the sanitary conditions of the establishments where they are prepared. The act also established the policy relating to the management of the forest reserves, and interpreted the Adams Act doubling the appropriation for agricultural experiment stations.

This year the appropriation act also contained important legislation relating to the management of funds arising from the forest reserves, carried a permanent increase for agricultural education which will double the present appropriation in five years, extended the Federal inspection to include human foods, and increased the aid to be given in the eradication of the Texas fever cattle tick in the South, and the gypsy and brown-tail moths in the New England States. A proposition looking to the protection of the grazing lands of the public domain, by placing them under the control of the Secretary of Agriculture, with authority to organize grazing districts, to regulate their use, issue permits or leases, etc., was considered at length but failed of passage.

The inspection duties of the Department are steadily increasing. In addition to the meat and food inspection, the amount for grain inspection is increased from $15,000 to $40,000, and the inspection of seeds of grasses, clover, and alfalfa is continued. This police work is quite a new feature and is one of the noteworthy tendencies in the development of the Department. Without necessarily centralizing this service, there are manifest advantages to the country at large from a uniform control of certain products intended for interstate shipment, and a much broader and more effective influence is exerted than could be the case by the States working alone and independently.

The act marks a more liberal tendency in the matter of salaries. There were material increases in the salaries of the Secretary, Assistant Secretary, and the chiefs of three bureaus, the latter being brought up to $5,000. A provision was also inserted raising the maximum salary which the Secretary is authorized to pay to investigators or others engaged in scientific work from $3,000 to $3,500. This is gratifying recognition of the merits of such service as compared with that in other branches of Government and scientific work, and of the position which agricultural investigation is attaining.

The total amount carried by the agricultural appropriation act for 1907-8 is larger than in any previous year by nearly $3,000,000. The appropriation for "routine and ordinary work" is $8,692,290. The emergency appropriations and the increase for the agricultural colleges for the coming year bring the total up to $9,447,290, to which should be added a permanent appropriation of $3,000,000 for meat inspection. If to this is added the Adams fund for next year, amounting to $432,000, which is administered by the Department and hence is quite as properly included here as the Hatch fund, the grand total is $12,879,292. The amount exceeds the appropriation of two years ago (1905-6) by over $6,000,000, and represents an increase of nearly 100 per cent. This increase is in large measure covered by the extension of the inspection work of the Department upon meat and other articles of food.

The Bureau of Animal Industry now greatly exceeds all other Bureaus in the amount of its fund. Its regular appropriation is $1,032,480, a net increase of $85,500 over last year. To this is to be added the funds for the eradication of the cattle tick in the South, which is increased from $82,500 to $150,000, with $25,000 made immediately available, and the permanent appropriation of $3,000,000 for executing the meat inspection law. The latter was made permanent legislation. The appropriation for animal-breeding experiments was increased from $25,000 to $50,000, and an attempt to restrict one-

half to horse breeding failed. The fund for developing the dairy industry in the South, which was included last year, was not renewed. The provision for experiments in cooperation with the Minnesota Station with a view to developing antitoxins or preventive vaccines was continued.

The Weather Bureau was given a slightly smaller appropriation than the previous year, the amount being $1,413,540. The usual appropriation for the erection of buildings was stricken out on a point of order, and the cost of maintenance of the printing office was limited to $18,000.

The Bureau of Plant Industry was increased $132,490, the total appropriation being $1,052,230. This increase was largely for general maintenance and extension of the present lines of work, but included an increase of $25,000 for the grain inspection, as previously noted. The fund for the Congressional seed distribution, in spite of the extended discussion of its merits, was retained in the bill as passed, the amount being $238,000, of which $36,000 may be used for the introduction of seeds and plants from foreign countries. In addition to the above amounts, the Bureau received a considerably larger proportion of the emergency appropriation for cotton boll weevil work, the amount assigned to it being $150,000, out of a total of $190,000.

The amount for the Forest Service was increased to $2,400,000, but $1,000,000 of this was in lieu of the estimated receipts from the reserves, which must henceforth be turned into the Treasury instead of being used in their management. The sum of $500,000 was appropriated for "the proper and economical administration, protection, and development of the National forests," $125,000 of which is immediately available. Authority to conduct experiments and investigations in Washington was refused. The authority of the President to establish forest reserves was rescinded, it being stipulated that future reserves or additions in Oregon, Washington, Idaho, Montana, Colorado, or Wyoming are to be made only by act of Congress. In response to the widespread movement for the establishment of forest reserves in the Appalachian and White mountains, authority was given for a survey and report on these watersheds with regard to their area and natural conditions, the price at which they can be purchased, and "the advisability of the Government purchasing and setting apart the same as national forest reserves for the purpose of conserving and regulating the water supply and flow of said streams in the interest of agriculture, water power, and navigation." Twenty-five thousand dollars was appropriated for this purpose and made immediately available.

The Bureau of Chemistry received $650,000 for general maintenance, including the execution of the pure-food law, which, with

the statutory roll, brings its total up to $697,920. The provisions for fixing standards and for the inspection of imported food products, which were carried by the last appropriation act, were stricken out. All sums or compensation paid to State or local officials in connection with the food-inspection work are to be reported in detail to Congress not later than next March. Sufficient authority for the fixing of standards and other duties in connection with the execution of the law are believed to be contained in the pure food law.

For the Bureau of Entomology the amount was increased to $136,010, an increase of $41,400, $10,000 of which may be used in experiments looking to the eradication of the "white fly." Tobacco insects, especially in Kentucky and Tennessee, are included in the list of pests to be studied. The Bureau receives $40,000 of the appropriation for cotton boll weevil work, and an increase in the emergency appropriation for combating the spread of the gypsy and brown-tail moths from $82,500 to $150,000, the appropriation being made immediately available.

The Bureau of Statistics receives an increase of $8,380, its total appropriation being $219,940, for the collection of statistics and the study of foreign markets.

The appropriation for the Bureau of Soils was decreased $15,000, in view of the assignment of certain features of the tobacco work of the Bureau to the Bureau of Plant Industry. The amount carried by the act is $206,980.

The Office of Experiment Stations received a considerable increase in the statutory roll and in the appropriation for various lines of work. The general maintenance fund was made $30,000, and the appropriation for the Alaska, Hawaii, and Porto Rico experiment stations was increased $9,000 in the case of each, in order to make the amount equal to that received by the State stations under the Adams Act. For irrigation and drainage $150,000 was appropriated, an increase of $27,800 over last year, and the $5,000 for farmers' institutes and agricultural schools was continued. The general appropriation for nutrition investigations was stricken out on a point of order, but subsequently a clause was inserted providing $5,000 for packing, moving, and storing the respiration calorimeter now housed in one of the buildings of Wesleyan University. The total appropriation for the Office, including that to the stations under the Hatch Act, is $1,013,220.

The same appropriation was made for the Biological Survey as last year, $52,000, but the Secretary was directed to report to what extent, if any, the work now being done by the Survey is duplicated by any other Department of the Government, and the practical value of the work to the agricultural interests of the country.

The appropriation for the Division of Publications was $161,550,

but this does not include, as was formerly the case, the amount for printing Farmers' Bulletins, which from now on is carried in th sundry civil act. The amount there designated for this Department, to include the first cost of the Yearbook and the miscellaneous reports which are made to Congress, is $433,750, of which amount $98,750 is for Farmers' Bulletins, and $25,000 for the publications of the Weather Bureau.

The Office of Public Roads received the same appropriation as last year, $70,050, and the Library $28,380, an increase of $2,500. Other items of the act are Office of the Secretary $119,200, Division of Accounts and Disbursements $41,790, and contingent expenses $47,000.

The increase in the appropriation for the colleges of agriculture and mechanic arts is a matter of much gratification to all interested in the progress of these institutions and familiar with their need of additional funds. It reaffirms the policy of the General Government to favor and develop these land-grant institutions, legislation for which has now extended over a period of 45 years.

The act of 1862 donated to the States and Territories lands from which over $12,000,000 has been realized as a permanent endowment, with over $4,000,000 worth still unsold. The supplementary act of 1890 has given them $1,200,000 annually for more than a decade past; and the present act, known as the Nelson Act, increases the amount to each State $5,000 a year for five years, when the appropriation will be double that at present and will be continued permanently at that rate. Although the new measure is carried by the agricultural appropriation act, it will be administered like the Morrill fund by the Bureau of Education, and not by the Department of Agriculture.

The appropriation was carried through on the merits of agriculture. The law itself mentions the agricultural work prominently, and the discussion in Congress hinged almost exclusively on the value and growing importance of agricultural education, and the needs of developing that phase of our educational system. These needs in connection with our colleges are very acute, as every one will admit who is familiar with the relatively meager equipment in men and materials for instruction in that branch. Now that the methods of instruction have been worked out on a broader and more efficient basis, and the desire for instruction in agriculture has become more widespread, it is fair to expect that the land-grant colleges the country over will recognize the opportunity presented by this new appropriation to develop and strengthen agricultural education.

Press dispatches report the death at Paris, France, March 18, of Pierre Eugène Marcellin Berthelot, the distinguished French statesman and scientist, whose work contains much of interest and value to agriculture.

Berthelot was born in Paris October 25, 1827. Early in life he showed marked taste for philosophical studies and chemical research, and during the more than fifty years of his unusually active and productive scientific career, beginning practically with the enunciation of his theory of polyatomic alcohols in 1854, his work has covered nearly every branch of chemistry and included besides many important contributions to physics, botany, and agriculture. Indeed his scientific work is preeminently distinguished by its breadth of conception and the boldness and success with which he made all departments of science concerned contribute to the investigations he undertook, thus attesting an extraordinary breadth of knowledge and sureness of grasp of science in many fields. To an unusual degree he made science in its various departments subservient to his purpose in working out the particular problem which he had under investigation.

Berthelot's philosophy and science was of that constructive kind so well exemplified by those researches in synthesis of organic compounds beginning in 1854 and continuing to the end of his career, which give him his strongest title to fame. When he began his work in this line Wöhler had already prepared urea synthetically from its inorganic constituents, and a few other syntheses of similar character had been made, but, as a recent writer states, "they were so isolated, so insignificant, and so barren of fruit that all attempts to constitute organic bodies by bringing together the elements of which they are composed were as a rule regarded as chimerical." Yet Berthelot attacked this problem with such energy that in a comparatively short time he greatly increased the number of synthetically prepared organic compounds entering into the composition of living organisms, and elucidated the laws and devised a system of processes by which organic compounds may be formed from inorganic elements. In fact it may be said that he introduced the synthetic method into organic chemistry.

Among the important compounds thus prepared by him were oxalic and formic acids, methyl alcohol, glycerine, camphor, oils, and acetylene. The ultimate aim of his efforts in this direction was the production of albuminous and carbohydrate bodies, of which he said: "The reconstitution of the saccharine and albuminoid principles is the final object of organic chemistry, the most remote one indeed, but also one of the most important, on account of the essential part which these principles play in our economy. When science attains it, it will be able to realize the synthetic problem in its whole extent—that is, to produce, with the elements and by the play of molecular forces alone, all the definite natural compounds and all the changes which matter undergoes in the bodies of living beings."

Berthelot expressed the belief that the synthesis of the food nutrients, fats, and sugars will probably be followed by the artificial prep-

aration of others until ultimately all food materials, beverages, condiments, narcotics, etc., will be made by artificial processes instead of derived from natural products.

In connection with his studies of the thermal relations of respiration and tissue building in plants and animals, Berthelot made important contributions to thermo-chemistry. The bomb calorimeter, which is now extensively used in the study of the fuel value or heats of combustion of foods and feeding stuffs, is a product of his labors in this direction. He also successfully applied the bomb calorimeter in the development of a new method of elementary organic analysis.

Berthelot's more strictly agricultural contributions were very large and of the highest order of importance. He was among the first to demonstrate the fixation of free nitrogen in the soil by microscopic organisms, independent of or in symbiosis with higher plants. He has probably done more than any other modern scientist to explain the true nature of the humus compounds of the soil. His Plant and Agricultural Chemistry (*Chimie Végetale et Agricole*), the publication of which was begun in 1899, and which consists of four volumes containing about 2,000 pages, is a collection of the reports of the work of the author, especially at the station for plant chemistry at Meudon, which appeared from time to time in the *Annales de Physique et Chimie.* The first volume deals with the fixation of free nitrogen by soils and by plants, the second is devoted to general studies on plant growth and the chemical action of light, the third includes special studies on plant growth, and the fourth is devoted to studies of cultivated soils and of wine. In recent years he had made important and interesting contributions to the history of chemistry.

The varied and valuable character of Berthelot's contributions to agricultural science will be evident to any one who will take the trouble to consult the files of *Annales de Physique et Chimie*, *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, or this journal. The latter will show references to some forty important contributions on agricultural subjects within the last fifteen years.

Berthelot's eminence in science was recognized throughout the world and he received many honors, political as well as scientific. He was a life member of the French Senate, and had been successively Inspector-General of Higher Education, Minister of Public Instruction, and Minister of Foreign Affairs. He was a grand officer of the Legion of Honor, and succeeded Pasteur as permanent secretary of the French Academy of Sciences. He was a member of the Institute of France, as well as of the most distinguished scientific societies of other countries.

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RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

The determination of nitrogen in nitrate of soda, U. VAN DAM (*Rec. Trav. Chim. Pays-Bas et Belg., 25 (1906), pp. 291–296; abs. in Chem. Abs., 1 (1907), No. 2, p. 152; Jour. Chem. Soc.* [*London*], *90 (1906), No. 530, II, p. 898*).—A method based upon the oxidation of oxalic acid by the nitrate in presence of manganese sulphate with subsequent determination of the excess of oxalic by titration with potassium permanganate, is described, and comparisons of it with the Schloesing method are reported. The oxidation is effected by heating the mixture at 100° C. for $3\frac{1}{2}$ hours in a flask provided with a reflux condenser and charged with carbon dioxid.

Detection of nitric acid, P. SOLTSEIN (*Pharm. Ztg., 51 (1906), No. 69, pp. 765, 766; abs. in Chem Centbl., 1906, II, No. 12, pp. 1020, 1021; Jour. Chem. Soc.* [*London*], *90 (1906), No. 530, II, p. 898*).—The interference of nitrous acid with the diphenylamin and brucin reactions is noted and attention is called to the fact that in testing for nitric acid by reduction to nitrous acid with zinc the reduction may be carried so far that the formation of starch iodid will be prevented. It is recommended that in presence of such substances as ferric or manganic oxids metadiamido benzol be used. Attention is called to the occurrence of traces of nitrate in filter paper.

Phosphomolybdic acid as a reagent for potassium, A. SCHLICHT (*Chem. Ztg., 30 (1906), No. 104, pp. 1299, 1300; abs. in Analyst, 32 (1907), No. 371, p. 64*).—Attention is called to the fact that phosphomolybdic acid forms with potash insoluble compounds of constant composition, and studies by the author of the reaction under various conditions indicate that it may be employed with advantage as a means of quantitative determination of potash. The reagent used consists of a nitric-acid solution of phosphomolybdic acid prepared by fusing ammonium phosphomolybdate with sodium carbonate and nitrate and dissolving the fusion in water acidified with nitric acid. The reagent is added to the nitric-acid solution of the potash salt and the yellow potassium phosphomolybdate is precipitated by heating the solution. Calcium, magnesium, and sodium compounds do not interfere, but ammonium salt, of course, gives the same reaction.

Causticizing of alkali carbonates by lime, M. LE BLANC and K. NOVOTNY (*Ztschr. Anorgan. Chem., 51 (1906), pp. 181–201; abs. in Jour. Soc. Chem. Indus., 25 (1906), No. 23, p. 1145; abs. in Jour. Chem. Soc.* [*London*], *92 (1907), No. 531, II, p. 22*).—The authors report determinations by direct and by conductivity methods of the solubility of calcium carbonate in water at 18 and 100° C. The amounts dissolved at these temperatures were 13 and 21 mg. per liter respectively, of which 65 and 72 per cent, respectively, were hydrolized, leaving the amounts actually in solution as carbonate 4 mg. per liter at 18° and nearly 6 mg. per liter at 100° C.

From these data and from others for the solubility of calcium hydroxid the authors calculated the equilibrium constants for the reaction of calcium hydroxid on potassium or sodium carbonate and also carried out experiments, starting both with alkali carbonate and lime and with alkali hydroxid and calcium carbonate. The results showed in general that the temperature and also the pressure were practically without influence on the final result. The

speed of reaction was perhaps greater at higher temperatures, but equilibrium was in all cases repidly reached.

The most complete conversion of alkali to hydroxid (98.1 to 99.1 per cent) was obtained in case of normal solutions of alkali carbonates at 100° C., the lowest (about 92 per cent) with thrice-normal alkali carbonate, which was the strongest solution used, the results with twice-normal carbonates being intermediate.

Determination of formaldehyde in milk, F. W. RICHARDSON (*Jour. Soc. Chem. Indus., 26 (1907), No. 1, pp. 3, 4*).—This is a preliminary note on efforts being made by the author to devise a method for the quantitative determination of formaldehyde in milk and other materials.

Sulphuric acid containing 0.05 per cent of ferric sulphate is added drop by drop to 5 cc. of milk in a porcelain dish with vigorous stirring after each addition. The liquid so obtained may be diluted with a mixture of sulphuric acid and water in equal parts in order to make color comparisons in glass cells by Lovibond's system. By this means the author estimates colorimetrically 0.002 mg. of formaldehyde.

In determining formaldehyde in aqueous solutions by this method it is necessary to add some albuminoid substance, and tests are being made to determine which will give the deepest color. Other nitrogenous bodies than albumoses have been found to give this reaction.

The estimation of preservatives in milk, H. S. SHREWSBURY (*Analyst, 32 (1907), No. 370, pp. 5–14*).—Tests of methods for the determination of formaldehyde and boric acid in milk are reported.

A new apparatus for the rapid and accurate determination of the fat content of milk, J. ADORJAN (*Ztschr. Landw. Versuchsw. Österr., 9 (1906), No. 12, pp. 1063–1066, fig. 1*).—A modification of the Gottlieb apparatus is described.

A simple fat extraction apparatus, G. S. FRAPS (*Amer. Chem. Jour., 37 (1907), No. 1, pp. 85–87, fig. 1*).—The author describes this mercury sealed apparatus as having some points of resemblance to Knorr's, but being much simpler in construction and less expensive.

Detection of the adulteration of butter with cocoanut oil and oleomargarin, L. ROBIN (*Ann. Chim. Analyt., 12 (1907), No. 1, pp. 14, 15*).—Applying methods to which reference has already been made (E. S. R., 18, p. 419), the author finds that dividing the index of saponification of pure butter by the percentage of fatty acids soluble in water gives a quotient in no case exceeding 39. The same procedure applied to margarin gave 1,791, to cocoanut oil figures varying from 129 to 142, and to mixtures of butter and 10 per cent of margarin or cocoanut oil figures above 39 in 48 out of 50 cases.

On the detection of cotton-seed oil, N. PETKOW (*Ztschr. Öffentl. Chem., 13 (1907), No. 2, pp. 21–25*).—Studies were made of the Halphen and Becchi reactions.

The two reactions are not believed to be dependent upon the same substance. The sensitiveness of the Becchi reaction depends upon the relative amount of the silver nitrate solution used. The two tests are considered necessary in determining the presence of cotton-seed oil, inasmuch as certain samples do not respond equally well to both tests. The colorimetric determination of the percentage of cotton-seed oil in mixtures with other oils is considered uncertain as the color of the Halphen test with different cotton-seed oils is not uniform.

Determination of sucrose and of reducing sugars in fluid saccharin products, F. G. WIECHMANN (*Internat. Sugar Jour., 9 (1907), No. 98, pp. 68–77*).—In view of results obtained in his investigations of the determination of sucrose and reducing sugars in fluid saccharin products, the author recommends for this purpose the retention of the present composition of Fehling's solution,

clarification with basic lead acetate before the determination of the sucrose and reducing sugars, and the exclusive use of a gravimetric method for the determination of both sucrose and reducing sugars. A gravimetric method for this purpose is given.

A rapid method for the determination of water in butter, C. E. GRAY (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 100, pp. 6, figs. 2*).—One form of the apparatus devised for this purpose is shown in the accompanying figure. (Fig. 1.)

A is a flask of a little over 70 cc. capacity. C is a graduated tube which is connected with flask A by means of a rubber stopper, B. The tube C is graduated after the glass stopper F has been ground into it, the zero mark being the end of the stopper. Each mark of the graduation represents 0.2 cc. E is a glass condensing jacket connected to the graduated tube C by means of a rubber stopper D.

The reagent used is a mixture of 5 parts amyl acetate and 1 part amyl valerianate.

In making a determination a 10-gram sample of butter wrapped in the parchment paper upon which it is weighed is transferred to the flask and 6 cc. of the amyl reagent is added. The apparatus is connected as shown in the figure, the condensing jacket is filled with cool water to within 1 in. of the top, and the stopper F is removed. The water is then distilled off by heating for 5 to 8 minutes and collected in the tube C. The flask is then disconnected and the stopper F inserted into the tube C. The tube is then inverted, the water in the condensing tube being poured out. The condensing jacket may then be removed. A little swinging and agitation will secure a separation of the water and reagent. The reading made when the tube and contents are cool shows the percentage of water in the butter.

Comparative determinations by this method and the official method of the Association of Official Agricultural Chemists agree closely.

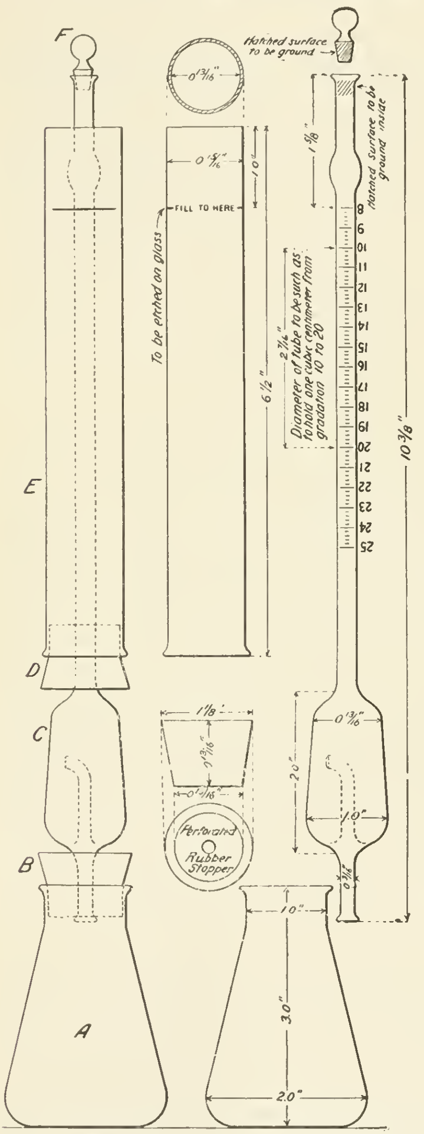

FIG. 1.—Apparatus for moisture determination.

Analysis of wine (*Feuille Vin. Gironde, 32 (1907), No. 4, pp. 13, 14*).—This gives the methods for the analysis of wine established by the minister of agriculture for use in the government laboratories of France.

Recent work on protein hydrolysis, J. R. GREEN (*Sci. Prog. Twentieth Cent. 1 (1907), No. 3, pp. 427–447*).—A concise summary of investigations which have been reported in recent years regarding the cleavage and structure of animal and vegetable proteids.

A text-book of sanitary and applied chemistry or the chemistry of water, air, and food, E. H. S. BAILEY (*New York and London: The Macmillan Co., 1906, pp. XXII+345*).—The first part of this volume, which is designed as a text-book for class-room use, is devoted to water, air, heating, lighting, and ventilation, and the second part to a discussion of food and beverages, including food adulteration. Throughout the book experiments are outlined, and the work as a whole constitutes a concise summary of data on the subjects treated.

Practical guide for the detection of adulteration and sophistication of food materials, P. BRETEAU (*Paris: J. B. Baillière & Sons, 1907, pp. VIII+386, pls. 8, figs. 143; rev. in Jour. Pharm. et Chim., 6. ser., 25 (1907), No. 2, pp. 89, 90*).—This volume is designed as a handbook for students, and contains descriptions of apparatus, chemical methods, and directions for the detection of the usual adulterants. The preface is by P. Cazeneuve.

Agricultural chemistry in the first half of the year 1906, W. ZIELSTORFF (*Chem. Ztschr., 6 (1907), No. 1, pp. 1–6*).—A summary account is given of progress in chemical investigations relating to plants and animal nutrition during the period.

Report of progress in inorganic chemical industry during the second and third quarters of 1906, G. RAUTER (*Chem. Ztschr., 6 (1907), No. 2, pp. 17–25*).—The literature of investigation and invention in this field is briefly reviewed. The investigations of special interest to agriculture noted in this review are those relating to the preparation of ammonia and other nitrogen compounds from waste products and from the nitrogen of the air.

Extracts from the proceedings of the association of official agricultural chemists, 1906 (*U. S. Dept. Agr., Bur. Chem. Circ. 32, pp. 14*).—This contains the reports of the committees on recommendations of referees, with the action taken by the association, the report of the committee on the revision of methods, the resolution adopted concerning the next place of meeting, and a list of the officers, referees, and committees for the year 1907. (See also E. S. R., 18, p. 396.)

International catalogue of scientific literature. D—Chemistry (*Internat. Cat. Sci. Lit., 4 (1906) pts. 1, pp. XI + 431; 2, pp. 432–2183*).—This is the fourth annual issue of this catalogue, previous issues of which have already been noted (E. S. R., 16, p. 745). Part 1 is arranged by authors and part 2 by subjects.

METEOROLOGY—WATER.

Some world's weather problems, W. J. S. LOCKYER (*Sci. Prog. Twentieth Cent., 1 (1906), No. 2, pp. 206–221, figs. 2*).—The great advances in meteorology made possible by improved means of exploring the upper air are referred to and the fundamental relations between barometric pressure and weather changes are discussed with especial reference to the barometric see-saw between nearly antipodal parts of the earth, which has been worked out by the author and Sir Norman Lockyer.

A map illustrating this phenomenon is given, and the general inverse relation between rainfall and pressure in India, Australia, and England during the period from 1870 to 1900 is also charted.

The general conclusions from these investigations on pressure observations are (1) that all over the world changes of long duration are in operation, and

(2) that these changes are not all alike either in intensity or time of duration. "In spite of these marked differences, there seems nevertheless to be an underlying connection between them all. It is not therefore without, but rather within, the bounds of possibility that the time will come when such apparent divergences will all be found to be very closely allied to each other, and be the natural resultants of one or more primary world atmospheric fluctuations."

On certain problems of the hydrosphere and atmosphere, T. C. CHAMBERLIN (*Carnegie Inst. Washington Year Book, 5 (1906), p. 171*).—"This paper proceeds on the assumption that the climatic problems of the earth center about the discovery and elucidation of a system of automatic control of such efficiency as to have kept the temperature of a large portion of the surface of the earth throughout its organic history within the narrow range of 100° C., and at the same time to have kept the constitution of the atmosphere within the like narrow range consistent with plant and animal life.

"The paper recurs to the fourfold organization of a typical atmosphere set forth in [a previous paper], and endeavors to apply the states of equilibrium deduced therefrom to the feeding and depletion of the atmosphere. It is recognized that the hydrosphere is a derivative from the atmosphere, and that its relations of equilibrium with the atmosphere are important factors. The relations of elquilibrium between the free atmospheric gases and those absorbed or held in feeble combination in the ocean are considered, together with the conditions and rate of exchange. The discussion of changes in the basis of equilibrium forms a vital factor.

"The function of the ocean as a source of atmospheric storage and supply is discussed and a possible reversal of the deep-sea circulation, alternating with circulation of the present order, is considered as a possible explanation of the alternation of warm polar temperatures with periods of marked glaciation and aridity. The sources of internal supply of atmospheric and hydrospheric material are reviewed and correlated with sources of depletion, so far as practicable. The function of deformation and base leveling in changing the available amounts of the critical atmospheric constituents is set forth. The relationship of the atmosphere's constituents to thermal absorption, retention, and radiation, and the bearing of these upon the climate, are also treated."

On the relations of equilibrium between the carbon dioxid of the atmosphere and calcium sulphate and calcium carbonate and bicarbonate in solutions in water in contact with it, J. STIEGLITZ (*Carnegie Inst. Washington Year Book, 5 (1906), pp. 171, 172*).—"This paper embraces the results of a computation of the varying equilibria subsisting between different degrees of concentration of carbon dioxid in the atmosphere and varying degrees of concentration of calcium carbonate and bicarbonate, and calcium sulphate in solutions in free contact with the atmosphere. It also considers the relative points of saturation of the calcium salts under varying conditions and the consequent order of their precipitation.

"The computations have been developed with reference to their application to certain of the problems of equilibria set forth in a preceding paper, and also incidentally to the order of deposition of evaporation deposits under conditions of aridity and other atmospheric states. They have been limited for the present to two cases, the first when the three calcium salts are present alone, and the second when they are present with other sulphates, of the nature and quantity found in the ocean at the present time."

Weather and crop yield, J. W. SMITH (*Ohio Nat., 7 (1907), No. 3, pp. 48–51, fig. 1*).—From a comparison of rainfall data and crop yields the author concludes that there is a short period in the growth of crops in which the yield

is greatly affected by favorable and unfavorable weather conditions, and "that the yield can be very closely approximated at the close of this critical period by an exhaustive study of the weather conditions and crop yields of previous years." Thus, charts showing the relation between the yield of corn in the 8 great corn-producing States in this country and the rainfall during June, July, and August during 1888 and 1902 indicated "that the rainfall in July controls the corn yield to a marked extent," and that by this means a very close estimate of the yield of corn per acre in the United States can be made by the latter part of July.

Charts which the author has prepared showing the departure of the average temperature, total rainfall, and crop yields from the normals by months, from 1876 to 1904, indicate a marked relation between the weather and the yield of various crops. The charts indicate that for the best yield of oats June and July should be moderately cool and dry; for barley the summer should be warm and dry; for potatoes a cool summer, with a fair amount of rain in June and July and a dry September; for hay abundant rainfall in April, May, and June. Wheat, rye, and clover are affected by winter conditions such as alternate freezing and thawing, short periods of severe cold, snow covering, etc., more than by monthly temperature or precipitation.

"The dates of blossoming of fruits depend to a marked degree upon the temperature of March and April. In general poor fruit yields have been preceded by cold winters and good yields by comparatively mild winters."

The law of sequence in the yield of wheat for eastern England, 1885–1905, W. N. Shaw (*Jour. Agr. Sci., 2 (1907), No. 1, pp. 17–28, figs. 2*).—A shorter article on this subject has already been noted (E. S. R., 18, p. 313).

This article discusses in some detail the question of the relation between yield of wheat and autumn rainfall, but more especially an apparent 11-year periodicity in yield as disclosed by a study of the yield of wheat for a selected part of England during the last 21 years. While the relation between yield of wheat and autumn rainfall has in recent studies not been found to be as close as was at first indicated, it still appears that the autumn rainfall is in a way the key to the subsequent seasons, and thus has an important bearing upon the wheat yield. An examination of the meteorological and wheat yield data shows that a wet autumn usually means a relatively dry spring and a deficient crop and vice versa.

Weather charts and reports, and their utility to the Indian agriculturist, W. L. Dallas (*Agr. Jour. India, 1 (1906), No. 4, pp. 329–337, chart 1*).—This article describes briefly the character of observations on pressure, temperature, humidity, rain, wind, weather, and sea disturbance made at the government observatories in India and attempts to show how weather charts and reports may be utilized by the individual observer "in forming a conjecture as to approaching weather."

It is pointed out that the charts "will be found most useful to those who study them continuously and carefully and combine with them careful and systematic observations of their own meteorological instruments and their local weather. . . . When considering what is the practical use to an agriculturist of weather charts, giving as they do a representation of conditions of weather already passed, it is necessary to acknowledge at once that the utmost they will permit a careful observer to do is to make an intelligent anticipation of coming events, an anticipation which may and indeed must frequently be incorrect, but which on many occasions will not be without value."

To-morrow's weather: How it is foretold, D. A. Willey (*Sci. Amer., 96 (1907), No. 5, pp. 108, 109, figs. 7*).—The preparation of the daily weather map

is explained and the more important pieces of apparatus used in weather observation are described.

The weather (*Ann. Rpt. Bur. Indus. Ontario, 1905, pp. 7–9, 19–23*).—Monthly summaries of observations at the principal meteorological stations in Ontario on temperature, precipitation (rain and snow), and sunshine for each year from 1896 to 1905 and for the period 1882 to 1905 are given.

The climate of extreme southern Texas, J. L. CLINE (*Gulf Coast Line Mag., 2 (1907), No. 3, pp. 30–45*).—Data from the records of the United States Weather Bureau with reference to the temperature and moisture conditions in the Texas coast country are summarized and discussed.

General résumé of climatological conditions and their effect on agriculture in Cuba during 1906, L. G. Y CARBONNELL (*Bol. Ofic. Sec. Agr. Cuba, 2 (1907), No. 1, pp. 30–42, pls. 2*).—Observations on temperature, rainfall, pressure, and sunshine at different meteorological stations in the island are summarized and briefly discussed with reference to general climatological and seasonal conditions by the chief of the meteorological service.

Climatological data for the year 1903 (*Com. Geogr. e Geol. São Paulo Bol. 17, pp. 149, map 1, dgms. 8*).—This is a detailed report of operations and observations by the meteorological service of São Paulo, Brazil.

Report on the meteorological observations made at the [Horticultural] Society's garden at Wisley in 1905, R. H. CURTIS (*Jour. Roy. Hort. Soc. [London], 31 (1906), pp. 169–182, figs. 3*).—Observations on temperature of the air in shade and on grass and of the soil at depths of 1, 2, and 4 ft., rainfall, sunshine, and wind movement, are summarized and the general characteristics of the weather are discussed for each month of the year.

Meteorological division, J. LYLE (*Orange River Colony Dept. Agr., Ann. Rpt., 2 (1905–6), pp. 337–351*).—The results of observations on pressure and temperature at 8 stations in Orange River Colony and on rainfall as recorded by 160 rain gages during the year ended June 30, 1906, are summarized.

Meteorology of the year 1906, J. DERÔME (*Rev. Sci. [Paris], 5. ser., 7 (1907), No. 2, pp. 55, 56*).—Observations on pressure, temperature, and precipitation at Parc Saint-Maur during 1903 to 1906 are summarized, with similar data for other places in France and other parts of Europe and Algeria.

Results of meteorological observations at Wiesbaden in 1905, E. LAMPE (*Jahrb. Nassau. Ver. Naturk., 59 (1906), pp. 54*).—Tables give details of observations on pressure, temperature, precipitation, humidity, cloudiness, and wind movement.

On the climate of Rostock with reference to harmonic analysis, J. LOEWENTHAL (*Beitr. Statis. Mecklenb., 14 (1906), No. 4, pp. 48, figs. 3, charts 3*).—Observations on temperature, pressure, precipitation, humidity, cloudiness, wind movement, electrical phenomena, etc., during periods dating back to 1853 are summarized and analyzed.

The meteorological elements of the Island of Poel, based upon 25 years' observations, B. BRENDEL (*Beitr. Statis. Mecklenb., 15 (1906), No. 1, pp. 56, charts 4*).—The island and the instrumental equipment employed are described and observations on pressure, temperature, precipitation, humidity, cloudiness, wind movement, etc., are summarized in tables and charts.

On the amount and origin of the ammonia in the products of the eruption of Vesuvius in April, 1906, J. STOKLASA (*Ber. Deut. Chem. Gesell., 39 (1906), No. 13, pp. 3530–3537; abs. in Chem. Abs., 1 (1907), No. 2, p. 160*).—The author reports the finding of ammonia and ammonium compounds in the gases and in the ashes and lava ejected from the crater, ammonium chlorid in some cases constituting 75 per cent of the water-soluble portion of the lavas and 33

per cent of the water-soluble portion of the lapilli. The ashes, however, yielded very small amounts of this compound. It is believed that the nitrogen is derived from nitrids.

Hail, E. SCHARF (*Der Hagel. Halle: Author, 1906, pp. VI+195, pls. 27, figs. 13; rev. in Ztschr. Landw. Versuchsw. Österr., 9 (1906), No. 11, p. 1017*).—This book discusses in a simple way the character of hail, but especially the injury which it does to different kinds of crops at various stages of growth.

Notes on water softening, W. D. COLLINS (*Engin. Rec., 55 (1907), No. 7, pp. 173–175*).—The author describes simple methods which can be used "by an engineer or other person without chemical training" for determining the treatment necessary to soften a hard water. These methods are practically the same as those recommended by the committee on standard methods of the American Public Health Association (E. S. R., 17, p. 334).

The purification of muddy waters, A. GAUDUCHEAU (*Bul. Écon. Indo-Chine, n. ser., 9 (1906), No. 59, pp. 1174–1187, figs. 2*).—A method of treatment with potassium permanganate, precipitation with iron salts, and filtration, which is claimed to be efficient, is described.

Purification of municipal water supplies, G. S. WILLIAMS (*Rpt. Mich. Acad. Sci., 8 (1906), pp. 122–127*).—This article briefly describes and discusses the efficiency of the slow sand and the mechanical or chemical method of filtration for the purification of water. The former is considered the safer method. The latter, however, gives good results in competent hands.

Ideals concerning municipal water supplies, I. C. RUSSELL (*Rpt. Mich. Acad. Sci., 8 (1906), pp. 128–136*).—Waters from deep sources are considered the safest, but these may become contaminated with disease-producing germs by exposure to the air. Surface waters and shallow wells are generally to be viewed with suspicion even when all practicable means have been employed to prevent contamination.

"In order to reduce the danger of surface water becoming unwholesome, every household, every community, every city, every factory, every slaughterhouse, etc., should be required to destroy or render harmless and unobjectionable its own refuse, before it is permitted to enter streams or other surface water bodies, and also before it is distributed in such a manner as to be dangerous or annoying through the action of the wind or in other ways."

The copper sulphate treatment of water supplies, K. F. KELLERMAN (*Surveyor, 31 (1907), No. 786, pp. 224, 236*).—This is an abstract of a paper on this subject read before the Biological Society of Washington, pointing out the efficiency of this method of treatment, but insisting that it should be considered at present as an emergency treatment and applied only under expert supervision.

The futility of a sanitary water analysis as a test of potability, M. O. LEIGHTON (*Biological Studies by the Pupils of William Thompson Sedgwick. Boston, 1906, pp. 36–53*).—In this article it is contended that the ordinary sanitary analysis is not a reliable means of distinguishing between a dangerous and a wholesome water, and that "the conventional method of seeking for evidences of pollution by sanitary analyses, or of accepting or rejecting a water upon such evidence, is in its broad and essential features quite misleading, too frequently dishonest, and in some cases absurd. . . . The term 'sanitary analysis' as used in this discussion does not include tests for specific organisms."

On the hygiene of drinking water, SMALAKIES (*Illus. Landw. Ztg., 27 (1907), No. 3, pp. 13–16*).—The judging of the hygienic quality of the drinking water on the basis of physical and chemical analysis is discussed and the results of examinations of 525 samples of drinking water from 201 farms are summarized.

Bacteria of the dairy wells in the vicinity of Washington, D. C., and their possible relation to typhoid fever at Washington, K. F. KELLERMAN and T. D. BECKWITH (*Engin. News, 57 (1907), No. 6, p. 152, fig. 1*).—This is a paper read at the New York meeting of the Society of American Bacteriologists December 29, 1906. The authors conclude as a result of their examination of a few dairies (especially the water supply) in the neighborhood of Washington, that "it would seem highly probable that, under the conditions portrayed, much of the typhoid of the city of Washington may be ascribed either directly or indirectly to the unsanitary dairy farms."

Shall pollution of Michigan streams be permitted? M. O. LEIGHTON (*Rpt. Mich. Acad. Sci., 8 (1906), pp. 119–121*).—Assuming that the streams of Michigan must inevitably be polluted, the author attempts to draw a definite line between permissible and unavoidable pollution and unreasonable or gross pollution.

Prevention of the bacterial contamination of streams and oyster beds, W. P. DIGBY and H. C. H. SHENTON (*Surveyor, 30 (1906), Nos. 777, pp. 653–655; 778, pp. 685–690*).—This article deals with progress which has been made in methods of sewage treatment since the exhaustive report of the Royal Commission on this subject (E. S. R., 16, p. 1032). It is asserted that methods of sewage treatment have now been devised by which "within reasonable limits of cost the dangerous qualities of the sewage may be wholly eliminated." The hypochlorite method is considered especially efficient for this purpose and its application and cost are discussed in some detail.

Public water supplies, sewage disposal, and stream pollution (*Ann. Rpt. Bd. Health Ohio, 20 (1905), pp. 61–220, 223–297*).—The systems followed in a large number of Ohio towns are briefly described and discussed, with results of examinations of a large number of samples of water proposed as public water supplies.

Farming for sewage purification, J. D. BROWN (*Surveyor, 31 (1907), No. 785, p. 196*).—The method followed at Consett, England, is briefly described. The sewage is applied mainly to fallow land, but also to soil on which hay and vegetables are grown. The purest effluents are obtained from cropped soil and from soil which has received sewage for some time.

SOILS—FERTILIZERS.

Soils; how to handle and improve them, S. W. FLETCHER (*New York: Doubleday, Page & Co., 1907, pp. XXVIII + 438, pl. 1, figs. 114*).—This is the third volume of the Farm Library series and attempts "to set forth the important facts about the soil in a plain and untechnical manner." Different chapters treat of soil builders; the nature of soils; the kinds of soils and how to manage them; soil water, the benefits of tillage; the objects and methods of plowing; harrowing and cultivating; rolling, planking, and hoeing; the drainage of farm soils; farm irrigation; maintaining the fertility of the soil; green-manuring and worn-out soils; farm manures; and commercial fertilizers.

The soils of Iowa, W. H. STEVENSON (*Farming, 3 (1907), No. 1, pp. 16, 17, figs. 1*).—The typical soil areas of the State are briefly described.

On moor culture, H. VON FEILITZEN (*Fyra Uppsalser i Växtkultur. Gothenburg, 1906, pp. 1–41*).—Practical advice is given in regard to the culture of moor soils, with a résumé of the results of recent experiments conducted at Jönköping Moor Culture Station.

The sand dunes of the desert of Islay (*Ann. Astron. Obscrv. Harvard Col., 39 (1906), pt. 2, pp. 287–292, figs. 2*).—Observations on the formation and movement of these dunes are briefly discussed.

The decomposition of the feldspars, A. S. CUSHMAN and P. HUBBARD (*U. S. Dept. Agr., Office Pub. Roads Bul. 28, pp. 29, figs. 6*).—This bulletin deals with studies of mechanical, physical, and chemical factors which modify the decomposition of feldspars, the results of which are thus summarized:

"(1) Water acts immediately upon finely powdered feldspars, as can be shown by an indicator, such as phenol phthalein. The reaction does not proceed far, owing to the clogging of the unremoved decomposition products.

"(2) The soluble alkaline bases set free by the decomposition are prevented from passing into solution by absorption.

"(3) The decomposition reactions can be made to go further by mechanical abrasion in the presence of water, by treatment with dilute solutions of certain electrolytes and by electrolysis.

"(4) The decomposition of ground feldspar can be made practically complete in the laboratory by properly combining these modifying factors."

The views regarding the mechanism of the decomposition reactions presented in previous publications (E. S. R., 17, pp. 301, 598) were confirmed in these later investigations.

It is stated that "the fundamental principles of the extraction of potash from finely ground feldspathic rocks by process of electrolysis, either with or without the addition of an acid to the anode chamber, have been made the basis for an application for a United States patent, so that the method may be used by the Government of the United States or any of its officers or employees in the prosecution of work for the United States, or by any person in the United States without the payment of royalty."

Experiments to determine the available phosphoric acid in soils, O. HOFMAN-BANG (*K. Landtbr. Akad. Handl. och Tidskr., 45 (1906), No. 3-4, pp. 316-333*).—Fertilizer trials with wheat, barley, beans, and mustard were made by the author during 1902-1905, and the amounts of phosphoric acid contained in the harvested crops compared with those extracted by different solvents recommended in soil analysis, as follows: Hydrochloric acid, sp. gr. 1.12, digestion for 3 hours on a water bath; hydrochloric acid, sp. gr. 1.019, digestion for 48 hours at room temperature; 2 per cent acetic acid, 48 hours' digestion; 2 per cent citric acid, digestion at room temperature for either 48 hours or 7 days.

The soil experimented with was a calcareous soil, containing 0.269 per cent total nitrogen. The following mineral components were extracted therefrom by the first solvent given: K_2O 0.33 per cent, P_2O_5 0.8 per cent, CaO 0.75 per cent, MgO 0.54 per cent, F_2O_3 3.22 per cent, Al_2O_3 3.88 per cent, and SiO_2 0.23 per cent. The results given go to show that for the soil experimented with, and very likely for soils of similar composition, digestion with 2 per cent acetic acid gives the most satisfactory indication of the content of phosphoric acid in the soil that is immediately available for plant growth.—F. W. WOLL.

Acid soils, A. L. KNISELY (*Oregon Sta. Bul. 90, pp. 23*).—This bulletin summarizes the replies made by 80 farmers in different parts of Oregon to a circular of inquiry sent out by the station regarding the character of the soil of their farms, the principal crops grown, the principal wild grasses and weeds, and the reaction of the soil as determined by the litmus paper test.

Of the 80 tests of soil for acidity made and reported by farmers, 10 per cent showed no acidity, 35 per cent very little acidity, 38.75 per cent considerable acidity, and 16.25 per cent strongly acid. The majority of the extremely acid soils examined in these tests were dark loam, muck, beaver dam or peat, which usually are rather poorly drained. "In a few cases upland sandy, gravelly clay loams have been found to be very acid. A majority of the sandy and clay loams examined possess a considerable degree of acidity.

"Plantain and sorrel were found to be more common than other weeds on soil containing considerable or very much acid. These weeds were also quite common on soils containing little or no acid.

"Acids in the soil are difficult to leach out. Acid soils may be improved by applications of quicklime, air-slaked lime, or wood ashes. The more thoroughly lime is incorporated with the soil the more effective will be its action on crop production."

Results of experiments on the liming of soils, H. J. Patterson (*Maryland Sta. Bul. 110, pp. 56*).—These experiments were a continuation of those previously reported in Bulletins 56 and 66 of the station (E. S. R., 12, p. 624). In addition to the results of the experiments, the bulletin gives some general information on liming soils and on the composition of lime and limestone.

The results of the experiments reported show that in a rotation of corn, wheat, and timothy and clover on run-down sandy loam naturally well drained, the limed plat gave larger yields than the unlimed plat, the average net return being $4.50 per acre annually; that an application of 20 bu. of lime gave only about 25 per cent more net profit than an application of 10 bu., and of 60 bu. only about 50 per cent more than 10 bu., the relative profits at the end of 4 years being in favor of 20 bu. per acre; and that on unproductive, stiff, wet, clay soil it is decidedly advantageous to use lime in combination with green manures (cowpeas) and stable manure.

The experiments on methods of applying lime and on the relative value of different forms of this material gave results slightly in favor of incorporating the lime with the soil before slaking and immediately upon application rather than using it as a top-dressing.

Oyster-shell lime was apparently somewhat more effective than stone lime, though the difference was not marked. Magnesian lime produced decidedly better yields of grain than the pure lime, though not quite so much forage.

In comparative tests barium oxid gave results very similar to those obtained with lime, indicating that the effect of lime is more largely due to chemical and physical action in the soil than to furnishing plant food.

Calcium carbonate gave decidedly better results than caustic lime, and the application of shell marl produced more grain and forage than either stone lime or oyster-shell lime. Caustic lime was cheaper and much more effective than gypsum. The same was true of finely ground oyster shells. Caustic lime was much more effective than gas lime of oyster-shell origin. Calcium phosphate in the form of finely ground raw phosphate rock gave better results than gypsum, but not so good as either carbonate or caustic lime. Soft-coal ashes produced little, if any, effect.

Lysimeter experiments, C. F. Eckart (*Hawaiian Sugar Planters' Sta., Div. Agr. and Chem. Bul. 19, pp. 31*).—This bulletin reports two series of experiments made with tub lysimeters described in previous publications of the station (E. S. R., 14, p. 554), the first to study the behavior of various nitrogenous fertilizers when applied to the station soil, the second to note the effect on the same soil of heavy applications of burnt lime, ground coral, and gypsum, with special reference to the rate of nitrification and the amounts of lime, potash, and phosphoric acid removed in the drainage under liberal irrigation.

First series (pp. 5–19).—In the first series of experiments nitrogen was applied in the form of tankage, fish scrap, hoof meal, nitrate of soda, sulphate of ammonia, and dried blood in amounts furnishing 1 gm. of nitrogen to each pound of dry matter in the soil. The soils in the lysimeters were irrigated first at weekly intervals and subsequently at biweekly intervals, the drainage being collected in galvanized iron containers and subjected to analysis. The largest

amount of water applied at any one time was at the first irrigation, which amounted to 2.94 in. In the three irrigations which followed 1.47 in. was applied, subsequent irrigations being 2.2 in. each.

The following table gives the results of determinations of nitric nitrogen in the drainage water of the different lysimeters expressed in percentages of the original amount of nitrogen applied to each lysimeter, namely, 16.3 gm.

Nitric nitrogen in drainage for different periods.

[Percentage of nitrogen added to soil.]

Period and date.	Tankage.	Fish scrap.	Hoof meal.	Nitrate of soda.	Sulphate of ammonia.	Dried blood.
Period 1, Mar. 14–Apr. 4	4.64	0.66	0.72	85.50	1.53	0.73
Period 2, Apr. 4–May 31	2.47	4.59	8.37	2.62	36.74	5.70
Period 3, May 31–July 25	4.26	9.91	18.07	.82	30.00	11.14
Period 4, July 25–Sept. 19	2.94	8.40	7.65	.94	5.91	10.21
Period 5, Sept. 19–Nov. 21	3.53	4.51	3.63	.54	1.40	2.89
Total	17.84	26.75	38.44	90.42	75.58	33.67

As will be noted, the amounts of nitrogen recovered as nitrate in the drainage water varied from 90.42 per cent in the case of nitrate of soda to 17.84 per cent in the case of tankage during a period of practically 8 months. It will also be observed that the nitrate of soda passed into the drainage water quite rapidly, 85.5 per cent being so recovered in the first period. The sulphate of ammonia was more slowly recovered and does not appear in large amounts as nitric nitrogen in the drainage until the second and third periods, but as a rule precedes in this respect the organic materials used. There was little evidence of any considerable amount of denitrification notwithstanding the fact that the moisture content of the soils was maintained at the high average of about 87 per cent saturation. Eight months after the various nitrogenous fertilizers were applied the drainage waters contained varying amounts of nitric nitrogen and this was as true of the nitrate of soda lysimeter as of the others.

Observations on the effect of nitrate of soda, sulphate of ammonia, and dried blood on the removal of lime from the soil showed that while soil to which none of these materials were applied lost 16.02 gm. of lime, that to which nitrate of soda was added lost 29.44 gm., 13.42 gm. of which was therefore due to the effect of the nitrate, and in the same way sulphate of ammonia was responsible for the loss of 19.58 gm. and dried blood 2.25 gm. These results with fresh water are quite contradictory to those obtained with saline water as previously reported (E. S. R., 14, p. 554).

Second series (pp. 20–31).—In the experiments with different lime compounds the materials used were applied at rates furnishing 100 gm. of lime per 100 lbs. of water-free soil; that is, at the rate of 3.92 tons per acre in case of burnt lime, 8.87 tons ground coral, and 11.08 tons of gypsum.

Examinations of the drainage water show that there was an approximate decrease of nitric nitrogen per acre of 1.69 lbs. in case of burnt lime, a gain of 3.1 lbs. in case of ground coral, and a decrease of 7.54 lbs. in case of gypsum as compared with the amount found in drainage of untreated soil. Calculated on the basis of gain or loss per ton of material, the figures are a decrease of 1.66 lbs. in case of burnt lime, a gain of 1.35 lbs. in case of ground coral, and a decrease of 2.61 lbs. in case of gypsum. The prejudicial effect on nitrification of the quicklime is attributed to excessive alkalinity produced by the use of this material. "The deleterious action of gypsum in this particular is, in the opinion of the writer, an indirect one, and was caused by the large amounts of

potash rendered soluble through displacement of that element by the lime of the gypsum."

The results reported show that an application of 472 gm. of gypsum resulted in an increase of potash in the drainage water amounting to 3.75 gm. equivalent to 198 lbs. per acre. With burnt lime only 9 lbs. per acre was removed in the drainage and there was a like loss in case of ground coral. The solubility of the phosphoric acid of the soil varied somewhat with the different forms of lime added, but the amounts were in every case very small, the largest amount being found in the drainage water of the check lysimeter, the smallest in the lysimeter to which gypsum was applied.

Note on an apparent secular change in the Rothamsted drain gages, E. J. RUSSELL (*Jour. Agr. Sci., 2 (1907), No. 1, pp. 29–34, fig. 1*).—This article discusses a question raised by observations reported in a previous article by Miller (E. S. R., 18, p. 116).

An analysis of observations with drain gages of different depth "seems to point to a secular change in the drain gages resulting in an increased evaporation of water. It is suggested that the change is brought about by the diminution of organic matter in the soil of the gages and the action of rain in washing out the finest particles."

Chemical and bacteriological soil studies, T. REMY (*Landw. Jahrb., 35 (1906), Sup. 4, pp. 1–62, figs. 2*).—Field, pot, and laboratory experiments with two unproductive acid soils compared with one which was of good quality and of slightly alkaline reaction are reported in detail, the object of the experiments being to determine the cause of the unproductiveness of the soils. For this purpose a careful study was made of the physical, chemical, and bacteriological properties of the soils.

The general conclusions reached were that the presence of free acid, deficiency of lime, and a consequent low bacterial activity were the most pronounced characteristics of the abnormal soils, and that when these conditions were corrected the injurious effects on plant growth were removed. In these soils lime acted less as a plant food than as a neutralizer of acidity.

Methods of bacteriological investigation of soils, III, F. LÖHNIS and A. E. PARR (*Centbl. Bakt. [etc.], 2. Abt., 17 (1906), No. 14–16, pp. 518–528, fig. 1*).—Experiments to test the putrefactive capacity of soils as described by Remy, Wohltmann, Fischer, and Schneider under different conditions of season, temperature, moisture, and food supply are reported, the general conclusion being reached that there is no such thing as a general putrefactive capacity of soils, but that this differs from time to time under the varying influence of season, temperature, and moisture content. Other investigations which bear out this conclusion are briefly reviewed.

On the occurrence and distribution of Azotobacter chroococcum in different soils, H. R. CHRISTENSEN (*Centbl. Bakt. [etc.], 2. Abt., 17 (1906), Nos. 3–4, pp. 109–119, figs. 2; 5–7, pp. 161–165, figs. 2; 11–13, pp. 378–383*).—As a result of a series of studies the author concludes that the occurrence and distribution of *Azotobacter chroococcum* in different soils is determined largely by the basicity of the soil, namely, its calcium carbonate content. The growth of Azotobacter in a mannite and potassium phosphate solution inoculated with a definite amount of soil furnishes an index of the calcium carbonate (also magnesium carbonate) content of the soil. The test can be made more conclusive by adding to the culture solution a small amount of Azotobacter culture in addition to the inoculating soil.

In like manner an indication of the content of phosphoric acid easily assimilable by Azotobacter can be obtained by using a culture solution which contains only potassium chlorid and calcium carbonate in addition to mannite,

Azotobacter can utilize in its growth secondary calcium phosphate as well as calcium salts of the organic acids, such as lactic acid and citric acid, in addition to calcium carbonate, but it can not utilize in this way tribasic calcium phosphate, calcium chlorid, and calcium sulphate. Thomas slag as well as secondary calcium phosphates are easily assimilated by Azotobacter, while iron and aluminum phosphates, bone ash and raw phosphates, and bone meal are almost unassimilable. The author believes that these facts encourage the hope that it may be possible to work out a biological method for determining in a general way the available plant food of soils.

The author's experiments show very positively that a certain amount of phosphoric acid and also of lime in the soil is an essential condition to the decomposition of mannite. He reports experiments with a soil which had been continuously fertilized for 12 years with nitrate of soda without liming and in this way exhausted of phosphoric acid, which when used to inoculate a culture solution of mannite, calcium carbonate, and potassium chlorid gave no reduction of mannite.

The author urges great care in the taking of samples for the determination of the occurrence and distribution of Azotobacter to prevent foreign infection, and points out that it is necessary to inoculate the solutions as quickly after the taking of the sample as possible. However, for biological reactions relating to the lime and phosphoric acid content such precautions are not of so much importance.

Some observations on the assimilation of atmospheric nitrogen by a free living soil organism—Azotobacter chroococcum of Beijerinck, S. F. ASHBY (*Jour. Agr. Sci., 2 (1907), No. 1, pp. 35–51*).—This article reviews briefly the history of investigations on nitrogen fixation, describes the preparation of cultures of *Azotobacter chroococcum* and the appearance of this organism, and reports tests of the rate of fixation of nitrogen by pure and impure cultures of this organism obtained from soil from Mombasa, East Africa; Cairo, Egypt, and Rothamsted, as well as in culture solutions inoculated with soil from different sources, some of which contained Azotobacter, and others were free from the organism.

The rate of fixation in pure cultures varied from less than 5 to more than 7 mg. of nitrogen for each milligram of carbohydrate used, the rate of fixation being apparently somewhat greater in the case of mannite than of glucose.

In the experiments in which the culture solutions were inoculated with soils from different sources the rate of fixation was 6.95 mg. of nitrogen for each gram of mannite in case of the soils containing Azotobacter and 3.22 mg. in case of soils which did not contain the organism.

The author states as conditions favorable for fixation of nitrogen (1) an abundant supply of air, (2) the presence of a base—calcium carbonate or, preferably, according to the author's investigations, magnesium carbonate, which not only more effectually neutralizes acidity due to foreign organisms in the early stages of culture, but also prevents butyric fermentation. The magnesium carbonate delays the development of the nitrogen-fixing organism somewhat, but the final yield of nitrogen is larger than with calcium carbonate.

The organism obtained from East African soils was in every way similar to that obtained from Rothamsted soil, except that fixation with it was more rapid and greater. It also possessed the property of turning brown and finally black with age, even in pure cultures.

It was observed that while *Azotobacter chroococcum* produces no spores, yet it can resist drying up in the air for a long time. "Old cultures of the organism on agar which had dried down to a leathery consistency after many months still showed abundant growth after pouring a fresh culture solution over them.

It is evident then that the organism can be freely distributed in dust by the wind."

A bibliography of 13 references to investigations on this subject is given.

On nitrogen bacteria, H. FISCHER (*Verhandl. Naturhist. Ver. Preuss. Rheinlande, 62 (1905), pt. 2, pp. 135–145, pl. 1*).—A study of the microscopic characteristics and behavior in cultures of different forms of Azotobacter is briefly reported and illustrated with several reproductions of microphotographs.

Can fungi fix the free nitrogen of the air and increase the total nitrogen of the soil? B. HEINZE (*Ann. Mycol., 4 (1906), No. 1, pp. 41–63; abs. in Centbl. Bakt. [etc.], 2. Abt., 17 (1906), No. 8–10, pp. 266, 267*).—The author shows that in addition to Azotobacter and Clostridium-like organisms there are many other organisms which fix nitrogen, as for example, blue-green algæ, which, however, have a lower fixing capacity than Azotobacter. Whether molds have the power of direct fixation is still questionable. Like the algæ, however, they aid the nitrogen-fixing organisms by supplying necessary carbonaceous food.

The formation of hydrocarbons of the acetylene series was observed in cultures of Azotobacter. In the fixation of nitrogen the first assimilation products are thought to be amino acids and the second probably salts of carbamin acid. From the high molecular amino acids the protein compounds may be gradually built up.

Studies on nitrogen fixation in cultivated soils, P. SCHNEIDER (*Landw. Jahrb., 35 (1906), Sup. 4, pp. 63–83, fig. 1*).—A series of culture and pot experiments with nitrogen-fixing bacteria (Azotobacter, etc.) and root tubercle organisms (horse-bean bacteria and pure cultures for peas prepared by this Department) in various media is reported.

The conclusions reached from these investigations are that nitrogen-collecting bacteria can fix amounts of nitrogen in the soil which are capable of being determined by analytical methods. This fixation is greatly increased by the addition of an organic source of energy such as mannite, glucose, etc., and is promoted by an alkaline reaction, as for example, by the presence of a suitable amount of lime. A calcareous soil is therefore especially favorable to the development of nitrogen-collecting organisms. The fixation of nitrogen can be very appreciably increased by the addition of potassium phosphate. Loose texture of the soil, permitting good aeration, also increases it. Root tubercle bacteria which had been grown on powdered chalk were more active as inoculating material than those which had been grown on gelatin.

Some observations on nitrification, S. F. ASHBY (*Jour. Agr. Sci., 2 (1907), No. 1, pp. 52–67*).—A series of observations on substitution of other bases, ferric hydrate and iron rust, for calcium carbonate; nitrification of ammonia absorbed by clay and peat; direct nitrification of a neutral ammonium salt; and the influences of ammonium salts and asparagin upon the oxidation of nitrites to nitrates by Nitrobacter, is reported, the results leading to the following conclusions:

"Carbonates are not the only substances in the soil which serve as bases for nitrification, since a marked nitrification of an ammonium salt can be brought about in the presence of ferric hydrate, either in the freshly precipitated state or as 'iron rust.' In solutions nitrification is not completed with this substance, probably because the ferric nitrite or nitrate formed dissociates and the solution becomes acid.

"Neither kaolin nor modeling clay serves as a base for nitrification.

"The double ammonium combination formed by the absorption of ammonium salts by modeling clay can most probably be nitrified in the absence of any base, but the corresponding combination with peat undergoes no nitrification in the absence of a base.

"The function of the base in nitrification is to form ammonium carbonate, which is alone directly nitrifiable, and the facility with which nitrification is set up by different carbonates depends upon the rapidity with which they can react with a neutral ammonium salt to produce ammonium carbonate. This reaction is greater with magnesium carbonate than with calcium carbonate, but is almost absent with copper carbonate, a result which is not due to a poisonous action on the organism.

"Ammonium salts and asparagin inhibit the oxidation by Nitrobacter of nitrites to nitrates, but this action can be largely obviated by (*a*) abundant inoculation of the organism, (*b*) allowing the organism to multiply before addition of the ammonium salt or asparagin, (*c*) inoculating with an organism which has become habituated in previous culture to ammonium salts or asparagin by gradually increasing the concentration of the latter substances."

On a new denitrifying bacterium isolated from goat manure, J. Hohl (*Landw. Jahrb. Schweiz, 20 (1906), No. 9, pp. 510–514*).—The microscopic characteristics and behavior under various culture conditions of this organism, to which the name *Bacillus denitrificans fluorescens* γ is given, are described. The organism is believed to be distinct from that described by Christensen under the name of *Bacillus denitrificans fluorescens* α.

Seed and soil inoculation, J. M. Hayman (*Rpt. Cawnpore [India] Agr. Sta., 1906, pp. 29, 30*).—Tests of Moore's method of inoculation on gram are briefly reported. Inoculation had little appreciable effect on the crop, even on soil which was supposed to be free from the organisms peculiar to this plant. This is thought to have been due to the fact that leguminous plants of all kinds grow freely throughout the region without artificial inoculation.

Soil inoculation (*Queensland Agr. Jour., 17 (1906), No. 6, pp. 271–273*).—This is a brief discussion of the utilization of nitrogen of the air by means of soil inoculation as described in publications of this Department and by electrical fixation as practiced in Norway by the Birkeland and Eyde process.

Soil inoculation for leguminosæ (*Country Life [London], 21 (1907), No. 526, p. 174*).—Directions for use of pure cultures in inoculating seed, soil, and growing crops, and statements regarding the success of such inoculation in practical tests in England, Scotland, and Ireland are quoted from a circular prepared by Professor Bottomley, of Kings College.

The industrial fixation of atmospheric nitrogen, G. L. Ragondet (*Ann. Gembloux, 16 (1906), No. 12, pp. 659–690, figs. 2*).—A rather complete summary of present knowledge relating to the fixation of atmospheric nitrogen in the form of calcium cyanamid and nitrates and nitrites, and the agricultural uses of these materials, is given.

The fixation of atmospheric nitrogen by electro-chemical means, H. Ingle and I. B. Pole Evans (*Transvaal Agr. Jour., 5 (1906) No. 17, pp. 137–139*).—This is a review of an address before the Society of Chemical Industry by P. A. Guye, already noted (E. S. R., 18, p. 218).

An arrangement of electrodes for electric ovens for treating gases, K. Birkeland and S. Eyde (*Norwegian Patent No. 15,706, Oct. 23, 1905; abs. in Chem. Ztg., 30 (1906), No. 104, Repert. No. 57, p. 475, fig. 1*).—A water-cooled electrode is described.

Utilization of atmospheric nitrogen for agricultural purposes (*West Indian Bul., 7 (1906), No. 3, pp. 237–250*).—This is a review of recent literature on this subject taken largely from Experiment Station Record and annual reports of the Chemical Society of London.

What is the practical value of the new nitrogen fertilizers as shown by the experiments already made? T. Alexander (*Separate from Wiener Landw.*

Ztg., 1906, No. 94, pp. 10).—Various experiments with lime niter, lime nitrogen, etc., in comparison with ammonium sulphate and nitrate of soda are reviewed, showing that while these newer products are not equal to nitrate of soda in fertilizing effect they show a high degree of efficiency as fertilizers and can now be made at prices which will make them a factor in regulating the price of nitrate of soda, this being especially true in case of the lime niter.

On the future supply of combined nitrogen, S. ZEISEL (*Wiener Landw. Ztg., 1906, Apr.; abs. in Staz. Sper. Agr. Ital., 39 (1906), No. 6–7, pp. 623–629*).—This article discusses the possibilities of the natural deposits and of the various methods of artificial preparation of nitrogen compounds.

Pot experiments on the action of lime nitrogen, A. STUTZER (*Landw. Vers. Stat., 65 (1906), No. 3–4, pp. 275–282; abs. in Jour. Chem. Soc. [London], 92 (1907), No. 531, II, p. 48*).—The literature of fertilizer experiments with lime nitrogen is reviewed and pot experiments carried out by the author are briefly reported.

In pot experiments with rye followed by three crops of mustard in succession without further manuring the lime nitrogen gave nearly as good results as nitrogen in ammonium sulphate and better than that of sodium nitrate, the low results with the latter being attributed to leaching.

The technical problem of nitrates, G. HOSTELET (*Rev. Écon. Internat., 4 (1906), No. 3, pp. 620–630*).—The world's supply of nitrates and the possibility of increasing this supply by artificial means are discussed.

The artificial production of nitrate of lime, J. B. C. KERSHAW (*Sci. Prog. Twentieth Cent., 1 (1906), No. 2, pp. 361–364*).—A brief account is given of the progress which has been made in electrical fixation of the nitrogen of the air.

Fall application of nitrate of soda, P. PIPERS (*Rev. Gén. Agron., n. ser., 1 (1906), No. 8, pp. 325–339*).—Cooperative plat experiments with rye, wheat, oats, potatoes, beets, and clover, to test the advisability of applying nitrate of soda in the fall are briefly reported.

The general conclusions reached were that a small application of nitrate of soda is indispensable for cereals on soils poor in nitrogen, such application insuring a profitable return. Small applications of nitrate in the fall are also recommended on good soils when the seeding is late. In this case, even though there may not be a direct benefit, the necessary expenditure is advisable as an insurance against winter injury.

The production of ammonium sulphate in Italy, C. MONTANARI (*Staz. Sper. Agr. Ital., 39 (1906), No. 6–7, pp. 610–617*).—Statistics on this subject are briefly summarized.

The manufacture of superphosphate, C. ELSCHNER (*Amer. Fert., 25 (1906), No. 5, pp. 5, 6, fig. 1*).—This article discusses especially European methods of recovering and utilizing the fluorin gases driven off in the preparation of superphosphates.

A process for preparing easily soluble compounds of phosphoric acid and silicic acid, W. WOLTERS (*German Patent No. 170,353; abs. in Ztschr. Angew. Chem., 20 (1907), No. 1, p. 32*).—The process consists of fusing raw phosphates with lime and artificial silicates and rapidly cooling the fused mass with cold water or by throwing it upon cooled metal plates. It is claimed that by this means the phosphoric acid is rendered almost completely citrate soluble. It is also claimed that the artificial silicates are better adapted to the process and yield a product of higher citrate solubility than the natural silicates.

Investigations on the action of Wolters phosphate, A. STUTZER (*Deut. Landw. Presse, 33 (1906), No. 93, p. 737; Landw. Vers. Stat., 65 (1906), No. 3–4, pp. 283, 284*).—This article briefly refers to experiments by various investigators

with this material, prepared by fusing raw phosphate with sulphate, lime, sand, and a little charcoal. Pot experiments by the author on hemp and mustard are reported, in which Wolters phosphate gave results in every case somewhat superior in case of hemp and inferior in case of mustard to those yielded by superphosphate.

Comparative fertilizer tests with Thomas slag and agricultural phosphate, BRANDT (*Hannover. Land u. Forstw. Ztg., 58 (1905), p. 1226; abs. in Centbl. Agr. Chem., 35 (1906), No. 11, p. 784*).—Field experiments with oats, rye, and clover are reported which indicated that the Thomas slag was more effective than the agricultural phosphate (fine-ground raw phosphate).

Experiments with Thomas-ammonium phosphate, BACHMANN (*Fühling's Landw. Ztg., 55 (1906), No. 23, pp. 808–814*).—Experiments on rye, oats, and moor meadow grasses are reported which show that the separate application of ammonium sulphate and Thomas slag gave much better results than the Thomas-ammonium-phosphate.

The stimulating effect of phosphatic fertilizers, CLAUSEN (*Illus. Landw. Ztg., 25 (1905), No. 35, pp. 327, 328; abs. in Centbl. Agr. Chem., 35 (1906), No. 11, pp. 783, 784*).—The author concludes from the results of a number of years experiments with various fertilizing materials that both Thomas slag and superphosphate exert a stimulating effect on plants, the effect of the phosphate on the young plants being more marked than that of nitrogenous fertilizers, but being observed especially in case of sandy and moor soils which are poor in phosphoric acid.

On the natural changes which manure undergoes, VAN DER ZANDE (*Deut. Landw. Tierzucht, 1906, No. 24, p. 44; abs. in Centbl. Agr. Chem., 35 (1906), No. 11, pp. 721–725*).—Experiments with two well compacted heaps of strawy cow manure, each containing about 7,000 kg. of material, which lasted from June 4 to April 9 of the following year are reported.

The heaps rapidly lost in volume during the first months of the period, but the temperature was never very high, in no case exceeding 28° C. as compared with the 40 to 50° commonly observed in a fermenting heap of mixed manure.

An analysis of gas from the interior of the heap showed 22 per cent carbon dioxid and 15 per cent of marsh gas, apparently resulting from the decomposition of carbohydrates, particularly pentosans and cellulose. The principal product of the decomposition of the nitrogenous matter was ammonia, which was transformed into nitrates only on the surface of the heaps and never exceeded one-fiftieth of the total nitrogen.

Analyses of the material at the beginning and at the end of the experiment showed that there had been a loss of 20 per cent of dry matter, 7.4 per cent of nitrogen, 39 per cent of pentosans, 28 per cent of crude fiber, and 13.5 per cent of crude fat. The unusually small loss of nitrogen as compared with the 20 to 40 per cent losses reported in other experiments is attributed to the fact that unmixed manure was used and the heaps were well compacted.

The fertilizing value of poultry manure, P. LARUE (*Jour. Agr. Prat. Vit. et Écon. Rurale Midi France, 102 (1906), No. 5, pp. 203–217*).—This article contains a rather complete summary of information regarding the history of the use of such manures, factors which affect their composition, chemical composition of various kinds of manures, commercial value, preparation and application, legislation relating to their use, and a table of analyses reported by different investigators.

Wastes at salmon canneries (*Amer. Fert., 25 (1906), No. 5, p. 7*).—This is a quotation from an argument in favor of the enactment of laws to prevent the taking of food fishes for fertilizer purposes in Alaskan waters.

Fertilizers (*Bur. of the Census [U. S.] Bul. 57, pp. 41, 42; Jour. Soc. Chem. Indus., 25 (1906), No. 23, pp. 1162, 1163*).—The statistics reported show that during 1905 the fertilizer industry followed the general tendency toward consolidation, the number of establishments reported being 400 as compared with 422 in 1900.

The capital employed rose from $60,685,753 in 1900 to $69,023,264 in 1905, the value of the product increasing from $44,657,385 to $56,632,853. The amount and value of various materials used in the manufacture of fertilizers during 1905 are stated as follows: Phosphate rock, 888,571 tons valued at $4,244,554; potash salts, 312,600 tons valued at $5,497,774; nitrate of potash, 1,160 tons valued at $39,039; nitrate of soda, 42,213 tons valued at $1,760,432; wood ashes, 17,083 bu. valued at $2,050; acid phosphate, 320,559 tons valued at $2,912,010; ammonium sulphate, 10,540 tons valued at $600,856; cotton-seed meal valued at $2,376,448; and bones, tankage, and offal valued at $5,094,149.

Analyses of commercial fertilizers, M. B. HARDIN (*South Carolina Sta. Rpt. 1905, pp. 22–28*).—The results of inspection of fertilizers (including cotton-seed meal) during 1905 are summarized and compared with results obtained in previous years. Of the 522 samples of fertilizers examined, 13 were of a lower grade than was claimed for them.

Analyses of commercial fertilizers, M. B. HARDIN (*South Carolina Sta. Rpt. 1906, pp. 9–14*).—The results of inspection of fertilizers (including cotton-seed meal) during 1906 are summarized and compared with results obtained in previous years. Of the 506 samples of commercial fertilizers examined, 412 were of the grade claimed for them, 81 were of a higher grade, and 13 of a lower grade.

Commercial fertilizers in 1905–6, G. S. FRAPS (*Texas Sta. Bul. 85, pp. 20*).—This bulletin gives the text of the State fertilizer law, together with information regarding taking of samples, form of tag, terms used in reporting analyses, valuation of fertilizers, fertilizers for cotton, corn, rice, and potatoes, home mixtures, fertilizer recipes, and bat guano; and reports analyses and valuations of 238 samples of fertilizers examined during the season. It is reported that the amount of commercial fertilizers used in Texas is comparatively small, amounting to only 13,500 tons in 1905–6.

Commercial fertilizers, J. H. STEWART and B. H. HITE (*West Virginia Sta. Bul. 108, pp. 355–448*).—This is a complete report of fertilizer inspection in West Virginia during the year 1906, and gives guaranteed and actual analyses of 336 samples of fertilizers offered for sale in the State during that year.

Approximate unit cost of constituents of fertilizers and feeding stuffs (*Mark Lane Express, 96 (1907), No. 3928, p. 10*).—Schedules of trade values of the principal constituents of fertilizers and feeding stuffs in Great Britain are given and their use in calculating the value of these materials is explained.

The mineral industry during 1905: Its statistics, technology, and trade, edited by W. R. INGALLS (*New York and London: Engin. and Min. Jour., 1906, vol. 14, pp. 728; rev. in Jour. Soc. Chem. Indus., 25 (1906), No. 22, p. 1123*).—Among the materials of special agricultural importance for which statistics are given are phosphate rock, potassium salts, gypsum, and limestone.

AGRICULTURAL BOTANY.

Report of the department of botanical research, D. T. MACDOUGAL (*Carnegie Inst. Washington Year Book, 5 (1906), pp. 119–139, pls. 5, fig. 1*).—An account is given of the investigations being carried on at the botanical research laboratory, Tucson, Ariz., under a grant from the Carnegie Institution. The

facilities of this laboratory, known as the Desert Botanical Laboratory, are described, together with some of the investigations in progress. These include studies on the influence of altitude and climatic factors upon vegetation—acclimatization, movements, and distribution of desert vegetation, studies on transpiration, root habits of plants, soil and air temperatures, etc.

Report of the department of experimental evolution, Cold Spring Harbor, New York, C. B. DAVENPORT (*Carnegie Inst. Washington Year Book, 5 (1906), pp. 92–105, pls. 3, fig. 1*).—An account of the investigations in progress under the Carnegie Foundation at the laboratory of experimental evolution, Cold Spring Harbor, New York. Among the principal subjects are the inheritance of characteristics, unit characteristics, rôle of selection, origin of new characteristics, and identity of evolutionary processes in plants and animals.

The author states that the policy of the laboratory is not to seek after practical results, but to confine the investigations to a study of the laws of evolution and the various principles underlying them. After describing the equipment of the laboratory, brief preliminary reports are given on a number of the investigations.

Elementary species in agriculture, H. DE VRIES (*Separate from Proc. Amer. Phil. Soc., 45 (1906), pp. 149–156*).—In a paper presented before the Philosophical Society the author discusses the relative merits of plant breeding by the selection of unit characters and by the method pursued by some breeders wherein the resultant crop is secured by a prolonged system of elimination. He claims that selection by individual seed is much more successful than where the selection is made of a number of individuals, which must necessarily include some that are not pure races. Incidentally the author calls attention to the fact that the breeding experiments carried on by N. H. Nilsson and W. M. Hays corroborate his theory of evolution by mutation.

The existence of a semipermeable membrane inclosing the seeds of some Gramineæ, A. J. BROWN (*Ann. Bot. [London], 21 (1907), No. 81, pp. 79–87*).—While investigating the conditions governing the absorption of water by the ripe grains of certain cereals, the author made some experiments with the grain of a variety of barley, which indicated that the embryo and endosperm of this grain are contained within a semipermeable covering.

A number of experiments were carried on to test the permeability of this membrane to water, iodin solution, and various salt solutions, and it was found that the embryo and endosperm are inclosed within an envelope through which water and iodin readily pass to the interior of the grain, but acids and salt solutions are retarded. To test whether this envelope of the barley grain was due to living protoplasm or not, seeds were treated with boiling water, after which they were placed in a normal sulphuric-acid solution for 48 hours. Subsequent investigation showed that there was no penetration by the acid, indicating that the semipermeable property of the covering of the grain is not due to the action of living protoplasm. It seems probable that this property centers in the testa, but whether the property is confined to only one of the layers has not been definitely determined.

Experiments with oats, wheat, and rye showed that they all possess a similar semipermeable covering.

The culture of the excised embryos of barley on nutrient solutions containing nitrogen in different forms (*Trans. Guinness Research Lab., 1 (1906), pt. 2, pp. 288–299*).—Embryos of barley excised after germination were grown on different nutrient solutions containing a number of forms of nitrogen to determine the value of nitrogen as a nutrient for these plants.

In the experiments the actual increase in dry weight during growth, as well

as the increase in the amount of nitrogen, was determined, and in addition measurements were made of the plumules and rootlets. The forms of nitrogen employed were asparagin, aspartic acid, glutamic acid, leucin, phenylalanin, cholin, betain, allantoin, potassium nitrate, ammonium sulphate, tyrosin, and the unclassified nitrogenous substances occurring in malt, which are mainly malt peptones and malt albumoses.

The solutions containing ammonium sulphate, aspartic acid, glutamic acid, potassium nitrate, and asparagin showed progressive increases in their power to contribute nitrogen to the plant, culminating in asparagin. Asparagin appears to be the most profitable nutrient among the sources of nitrogen, just as cane sugar is among the carbohydrates.

The root development of the plantlets in water cultures was much shorter than where the plants were grown under more normal conditions, while the average length of the plumule was not affected to so great an extent.

The migration of nitrogen from the endosperm to the embryo during the limited germination occurring during the malting process (*Trans. Guinness Research Lab., 1 (1906), pt. 2, pp. 284–287*).—Studies were made to determine the transfer of nitrogen from the endosperm to the embryo during the germination occurring in malting barley.

Several varieties of barley were studied, and it was found that about 35 per cent of the endosperm nitrogen passed into the growing embryos during the 9 or 10 days' germination on the malting floors. It appears from the investigations that the permanently soluble nitrogen of malt is about double that of the corresponding amount of barley and that the insoluble proteids of the endosperm are metabolized during the malting process and brought into a condition in which they can be transferred to the embryo.

Recent investigations concerning root hairs and their secretions, F. Schleichert (*Naturw. Wchnschr., 22 (1907), No. 6, pp. 91–94*).—A summary is given of recent publications relating to the morphology and biology of root hairs, the influence of the medium on their development, the chemical nature of the root-hair secretions, and the acid secretions of root hairs, fungi, etc.

A stimulus to the production of cellulose and starch, J. B. Dandeno (*Rpt. Mich. Acad. Sci., 8 (1906), pp. 40–44*).—A study is reported on the effect of black rot of apples (*Sphæropsis malorum*) on the production of cellulose in the cell walls of the apple in the course of the decomposition of the fruit.

It appears that cellulose and starch are developed by the fungus *S. malorum* directly in the cells of the ripe apple long after its detachment from the tree. The development of the cellulose seems to be an adaptation of advantage to the fungus in enabling it to tide itself over unfavorable conditions. The apple is in a state of preservation after the fungus has acted upon it for some time, the ebony-like mummies being less subject to attacks of other fungi. The production of cellulose is the result of a stimulus upon the cell content induced by the fungus.

A botanical and a chemical study of tannins, J. Dekker (*Bul. Kolon. Mus. Haarlem, 1906, No. 35, pp. 221*).—This publication, which is part 1 of a proposed botanical and chemical monograph of the tannins, contains an extensive bibliography of the subject, arranged in chronological order, and treats of the botany and physiology of tannins. The distribution of tannins throughout the plant kingdom is traced, the different species known to yield tannins being mentioned and notes given on their geographical distribution. Under the physiological studies the author treats of the occurrence of tannins in the plant and gives an account of their physiological significance.

The formation of hydrocyanic acid in plants, W. R. Dunstan and T. A.

Henry (*Ann. Chim. et Phys., 8. ser., 10 (1907), Jan., pp. 118–125*).—The authors summarize investigations relating to the occurrence of cyanogenetic glucosids in varieties of *Phaseolus lunatus*. The claim made by some investigators that in the Java beans and some other varieties of *P. lunatus* several distinct glucosids are to be found is in the opinion of the authors not well taken, as they believe that they are merely forms of phaseolunatin.

Concerning the distribution of hydrocyanic acid in the plant kingdom, M. Greshoff (*Arch. Pharm., 244 (1906), No. 9, pp. 665–672*).—The author presented before the British Association for the Advancement of Science at the meeting in 1906 an account of the distribution of hydrocyanic acid in the plant kingdom, and the present paper gives an historical statement relating to the discovery of the various glucosids and their occurrence in various plants. Eleven different glucosids are mentioned as having been isolated, occurring in 34 families of plants represented by 86 genera and about 200 species.

Experiments with bacterial enzyms, E. O. Jordan (*Biological Studies by the Pupils of William Thompson Sedgwick. Boston, 1906, pp. 124–145*).—The author reports studies to determine the power of certain bacterial filtrates to liquify gelatin. A number of organisms were used in this investigation, and the results of the studies are given at length.

There was found to be no evidence that the presence of gelatin in a culture medium leads to any particularly rapid or abundant production of the specific ferment acting upon the gelatin. In simple nonproteid solutions of asparagin, lactose, and mineral salts, such as sodium phosphate and magnesium sulphate, gelatinase is produced by some bacteriological species quite as abundantly, although not generally so rapidly, as in nutrient broth or gelatin.

The reaction of the culture medium is apparently without effect upon the enzym production except as it affects the conditions of bacterial growth. The gelatin-liquifying enzyms in a number of instances were found to endure heat much better in an acid than in an alkaline or a neutral medium. The enzyms were also found to withstand heat better than the bacteria producing them, and in some instances manifested their activity at temperatures considerably above the thermal death point of these bacteria.

The action of formalin in hardening gelatin cultures was found to be without diagnostic value for the separation of species, the hardening being dependent upon the stage of digestion.

FIELD CROPS.

Practical farming, E. T. Shepherd (*London: Crosby Lockwood & Son, 1906, pp. VIII+154, dgms. 14*).—This book discusses the principles of agriculture, the improvement of soils; manures and their uses in relation to crops; root, fallow, corn, leguminous, and forage crops; permanent and temporary pastures; and farm buildings.

David Dickson's system of farming (*Atlanta, Ga.: Cultivator Pub. Co., pp. 80, figs. 15*).—A popular treatise on farm management as practiced by a successful Georgia farmer. Among the more important points discussed are the general treatment of land, the fertilization of soils and crops, and the growing of corn, cotton, wheat, potatoes, turnips, and vegetables. A chapter is also devoted to fruit culture and the care of stock.

Dry farming, G. C. Baker (*Jour. Dept. Agr. West. Aust., 14 (1906), No. 5, pp. 361–363*).—The methods of culture to be followed in order to conserve and utilize to the best advantage the soil moisture are briefly described.

Report of the associate agriculturist, C. L. Newman (*South Carolina Sta. Rpt. 1906, pp. 23–25*).—A brief report on the work of the agriculturist of this

station is given with notes on experiments with cotton, corn, wheat, oats, cowpeas, and sorghums.

A marked increase in yield from the use of commercial fertilizers on marsh land, J. Becker (*Deut. Landw. Presse, 34 (1907), No. 7, p. 46, figs. 4*).—The soil in question was a medium heavy reclaimed marsh soil which had received a dressing of barnyard manure in 1902 and had been used since then for pasturing young stock.

In 1905 a crop of oats was grown with different combinations of the following quantities of fertilizers per hectare: 900 kg. of Thomas slag, 600 kg. of kainit, 200 kg. of nitrate of soda, and 2,000 kg. of lime. With the use of all these substances together there was a net profit of 97.30 marks per hectare. When the lime was omitted the net profit was only 2.92 marks, and when any one of the other substances was omitted there was a loss in each case.

In 1906, when a crop of beans was grown, this same soil was given an application of 900 kg. of Thomas slag, 200 kg. of 40 per cent potash salt, and 70 kg. of nitrate of soda per hectare. The increase in the yield over the check test was 1,643 kg. of beans and 1,529 kg. of straw per hectare. The profit apparently due to the use of the fertilizers amounted to 240.55 marks per hectare.

The book of alfalfa, F. D. Coburn (*New York: Orange Judd Co., 1906, pp. 336, figs. 60*).—This book is a treatise on alfalfa, discussing the history, cultivation, and merits of the crop, and pointing out its uses as forage and fertilizer. Several chapters are devoted to the history, description, varieties, distribution, and productiveness of alfalfa, following which the subjects of seed and seed selection, cultivation, harvesting, and storing, and the uses of the crop for pasture, soiling, and feeding in other ways, together with its value in beef making, dairying, and other lines of animal husbandry are discussed.

A feature of the book is a chapter presenting the practical experience of alfalfa growers in 41 different States.

Agaves, their culture and use, with special consideration of Agave rigida var. sisalana, K. Braun (*Pflanzer, 2 (1906), Nos. 14, pp. 209–223; 15, pp. 225–240; 16–17, pp. 241–257; 18, pp. 273–288; 19, pp. 289–304; 20, pp. 307–310*).—A general discussion on the history and distribution of agaves is given and a list of specimens is described. The greater part of the article is devoted to *Agave rigida* var. *sisalana* and its climatic, soil, and cultural requirements. The commercial importance of the fiber and the methods employed in obtaining it are noted, and a bibliography of 234 references to articles and works treating of this subject is appended.

By what methods may brewing barley be improved? R. Bethge (*Landw. Wchnschr. Sachsen, 9 (1907) Nos. 1, pp. 3, 4; 2, pp. 11, 12; 3, pp. 20, 21; 4, pp. 31, 32, dgm. 1*).—This article discusses the improvement of barley for brewing purposes in a certain section of Saxony, which now produces brewing barley of good quality and high in yield, while from 25 to 30 years ago only small yields and a poor quality of grain were secured.

The method of carrying on the improvement work is described, the principal points sought after being given as color, form, and uniformity of kernel, yield of grain per head, fineness of glumes, high percentage of grain, small number of nodes with long upper internodes, uniform strength in germination, low protein content of grain, accurate and systematic pedigree breeding, and improved cultural methods. The work in the laboratory and the use of the plant nursery in connection with breeding barley are also discussed.

The use of potash in its relation to the quality of barley, E. Wein (*Ztschr. Gesam. Brauw., 29 (1906), No. 3, pp. 26; abs. in Centbl. Agr. Chem., 35 (1906), No. 12, pp. 811–815*).—Experiments were conducted to determine whether

it is advantageous on the more fertile soils to use kainit or 40 per cent potash salt in growing barley and to ascertain in what quantities and at what time the application should be made to be profitable.

In 5 tests with barley and wheat on fertile clay soils a general application of superphosphate and nitrate of soda, furnishing 75 or 100 kg. of phosphoric acid and 23 kg. of nitrogen per hectare, respectively, was made, and in addition 60 kg. of potash was applied in the form of 40 per cent potash salt or of kainit. These soils ranged in calcium carbonate from 0.16 to 1.06 per cent and in potash from 0.21 to 0.48 per cent. With every test the potash apparently increased the total yield, the increase amounting to 552 kg. of grain and 522 kg. of straw per hectare. When potash was omitted the protein content of the grain increased and the starch content decreased.

A gravelly soil containing 12.40 per cent of calcium carbonate and 0.13 per cent of potash, producing potatoes and fertilized with barnyard manure the year before, received an application per hectare of 90 kg. of phosphoric acid, 15 kg. of nitrogen, and 80 kg. of potash in the forms of superphosphate, nitrate of soda, and 40 per cent potash salt or kainit, respectively. Applying the potassic fertilizer some time before sowing the barley proved beneficial, and under these conditions kainit was the more effective. The increase in the yield of grain apparently due to the potash varied from 2.7 to 4.8 per cent and that of the straw from 3.4 to 9.3 per cent.

The third test was made on a clay soil with 0.32 per cent of calcium carbonate and 0.29 per cent of potash. A general application of 90 kg. of phosphoric acid as superphosphate and 24 kg. of nitrogen as nitrate of soda was given per hectare. In addition, 40 per cent potash salt was applied in quantities furnishing 25, 50, 75, and 100 kg. of potash. The season was the third after the soil had been fertilized with barnyard manure. Only the two smaller applications of potash in this experiment were profitable.

It is pointed out that barley requires phosphoric acid, nitrogen, and potash in a readily available form and in proper proportions, and that the quantities of potash given may be relatively small if the preceding crop was fertilized with barnyard manure but that they should be correspondingly increased when 2 or 3 years have elapsed since the manure was applied. It is stated that barley responds best to the use of kainit, but that on heavy soils 40 per cent potash salt is preferred to avoid crusting of the surface.

The author refutes statements of O. Reitmair with reference to his work and points to results secured by other investigators to prove his point.

Fertilizer experiments with fodder beets, C. DUSSERRE and E. CHUARD (*Bul. Soc. Vaud. Agr. et Vit., 1907, No. 201, pp. 358–362*).—Fodder beets were fertilized at the rate of 400 kg. of 17 per cent superphosphate, 200 kg. of 48 per cent of potash, and 300 kg. of nitrate of soda per hectare, this application costing 176 francs.

The average results obtained by 17 farmers showed an increase of 16,000 kg. of beets per hectare as apparently due to the fertilizers used. The profit per hectare is given as 224 francs. The season was dry, and not all of the plant food contained in the fertilizer application was used by the crop, so that in addition to the profit secured there remained in the soil a certain quantity of the plant food supplied for the succeeding crop. The beets from the fertilized plats contained 7.46 per cent of sugar and those from the check plats 7.52 per cent.

The Williamson plan of corn culture, C. L. NEWMAN (*South Carolina Sta. Bul. 124, pp. 20*).—This bulletin contains a detailed description of the Williamson method of corn culture and reports observations made on a number of

farms on which the plan was followed. "Where the plan was strictly adhered to the yield was double or more than double that secured from nearby fields of equal soil characters and where the usual methods of corn culture were practiced."

Three different varieties of corn were found to have been used on these fields. One variety, called Williamson corn, was grown on all fields except two, one of which was planted to Marlboro Prolific and the other to a variety similar to the Williamson corn. It was noticed that with the Marlboro Prolific the size of ears and their number per stalk were apparently uninfluenced by the method of culture.

The peculiar or essential features of the Williamson plan are summarized as follows: Deep and thorough preparation of seed bed, deep planting, infrequent and partial cultivation in early stages of growth, an increase of 200 per cent or more in the number of stalks per acre, postponing application of fertilizers until corn is given its second cultivation, intentional retardation of early growth of the stalk until its size is reduced ½ or ¼ its normal development, and following this augmented development of the ear by cultivation and heavy application of fertilizers made at appropriate intervals. The corn is planted 4 to 6 in. below the soil surface and laid by 4 to 6 in. above the level, leaving the lower 8 to 12 in. of the stalk below ground. It is suggested that the brace roots under these conditions are probably better able to perform their nutritive functions than when partly exposed.

Tillering of the corn plant, E. G. MONTGOMERY (*Lincoln: Nebr. Acad. Sci., pp. 35–42, pls. 4*).—The tillering of corn from a botanical viewpoint is discussed and the results of experiments previously noted (E. S. R., 17, p. 657) are reported. This article includes the report of a study on the tillering capacity of six different types of kernels. From 1,600 to 2,000 kernels of each type were planted and it was found that of the kernels having large germs from 85 to 90 per cent produced tillers, while of the kernels with small germs only from 55 to 70 per cent tillered.

The production of a new variety of maize, Zea mays var. pseudo-androgyna, by traumatism and fixation, L. BLARINGHEM (*Compt. Rend. Acad. Sci. [Paris], 143 (1906), No. 27, pp. 1252–1254*).—In a teratological study on maize the author found female flowers with the gyneceum surrounded with abortive stamens, and he reports having isolated a stable variety with this abnormal characteristic, which he named pseudo-androgyna. The hermaphroditic character is considered purely morphological.

The new variety was derived from a plant of which the stem was cut at the base in July, 1902. The new sprout, which subsequently developed, produced a tassel with the branches covered with fertile grains. Of the 28 plants grown from this seed in 1903, 20 showed the transmission of the abnormal character of the tassel. These plants grown by themselves and protected from foreign pollen gave rise to numerous forms, among them *Zea mays præcox*. *Zea mays pseudo-androgyna* did not appear until 1904, when the hermaphrodism was discovered. In 1905, 113 individuals from seed of this form transmitted this character to 97 plants, and in 1906 the results led to the conclusion that this variation was completely fixed.

The author believes that the plant mutilated in 1902 is the origin of a family marking a period in the progress of mutation and he concludes that violent mutilations at the proper time are a very effective means of causing abrupt, hereditary, and progressive variation.

The Red Texas oats question: A statistical study, H. F. ROBERTS (*Industrialist, 33 (1907), No. 16, pp. 243–253, figs. 5*).—After Red Texas oats has been

grown in Kansas for 2 or 3 years they apparently turn to a sort having black chaff, said to be inferior in yield and quality.

A sample of this kind consisting of 39 per cent of red and 61 per cent of black hulled kernels was separated into 2 lots of 2,309 black kernels and 1,486 red kernels. These 2 lots were compared with the original mixed lot. The result showed that 138 plants of the black variety bore 966 culms and 140 plants of the red variety 1,209 culms, showing that the red variety had a greater stooling capacity in this instance than the black variety. In another similar experiment conducted at the same time but with the plants standing one in a hill 4 by 6 in. apart, 76 per cent of a total stand was secured, the 3,090 plants of the black strain producing a stand of 78 per cent and the 2,880 seeds of the red variety a stand of 74 per cent.

The habit of growth of the 2 varieties showed a marked difference, the red sort spreading the leaves and young stems flat upon the ground while the black strain sent up erect stalks. The black oats came into full head June 22 and was ripe July 15, while the red oats was fully headed on June 26 and was ripe July 21, making a growing period of 95 and 101 days for the black and the red oats, respectively. A difference in habit in the heads of the 2 sorts was also observed, the panicles of the black oats being loose and spreading while those of the red variety were much more compact. The spikelets were as a rule more firmly attached in the red than in the black oats and the chaff of the red oats wrapped the grains more closely. The individual grains with their glumes were generally shorter and plumper in the red than in the black oats, but all possible variation and intergradation in form between the 2 types occurred.

In the plant nursery a statistical study showed that 143 plants of the red oats produced 572 heads and 8,980 spikelets weighing 309.80 gm., while the same number of black oat plants produced 374 heads and 10,767 spikelets weighing 445.766 gm. This result seems to indicate that the black variety is superior to the red in every essential point except stooling capacity.

The problem as to what the appearance of the black variety is due still remains to be solved.

The effect of the correct use of nitrate of soda in growing sugar beets, H. Briem (*Centbl. Zuckerindus., 15 (1907), No. 15, p. 394*).—The results of different experiments are reported and discussed with a view to showing that under proper conditions the use of nitrate of soda is not detrimental to the quality of sugar beets.

In an experiment conducted at Bonn on a sandy clay soil with a general application of 450 kg. of 16 per cent superphosphate and 200 kg. of 40 per cent potash salt per hectare, and special applications of 320 kg. and 480 kg. of nitrate of soda per hectare, there was an increase in the sugar content of the beet and in the total yield of sugar where the nitrate of soda was applied, but the heavier application did not give a profitable increase over the smaller quantity used.

The results of experiments carried on at Bernburg with the use of 300 kg. of nitrate of soda per hectare show a marked increase in the total yield of sugar as compared with the check plat, although the sugar content in the beet was reduced from 17.84 to 17.64 per cent. The use of 400, 500, and 600 kg. of nitrate of soda also showed slight reductions in the sugar content of the beet as compared with the check plat, and slight increases in the total yield of sugar as compared with the use of 300 kg. per hectare.

At Halle sugar beets were grown on sandy clay soil which had received a green manuring with peas and 40,000 kg. of barnyard manure per hectare, to-

gether with either a light or a heavy application of nitrate of soda. In both cases the use of nitrate of soda gave a profitable increase in the yield of sugar and the sugar content in the beet was also increased as compared with the check tests. In another experiment in which potash and phosphoric acid were applied instead of barnyard manure the use of the nitrate of soda also proved beneficial.

It is stated that the proper use of nitrate of soda is not injurious to the interests of the sugar manufacturer and that it often is a benefit to the farmer when the price of beets is low.

The effect of a too heavy application of nitrate of soda, H. Briem (*Centbl. Zuckerindus., 15 (1906), No. 8, p. 202*).—Analyses are reported of beets grown on a sandy, humus soil and very heavily fertilized with nitrate of soda in comparison with analyses of beets grown with a normal application of fertilizers.

The relation of sodium to potash in the heavily fertilized beets was as 1 : 0.73, while in the normally fertilized beets it was as 1 : 3.88. The normally grown beets contained 0.046 per cent of sodium, while in the heavily fertilized beets this element reached 0.133 per cent. The total nitrogen content was 0.195 per cent and 0.284 per cent for the properly and improperly fertilized beets, respectively.

It is pointed out that in experiments by Hellriegel it was shown that a high sugar content is associated with a definite relation between the potash and nitrogen content of 1 : 1, while in these experiments the relation was as 1 : 3.

The occurrence of dodder on sugar beets, A. Stift (*Bl. Zuckerrübenbau, 14 (1907), No. 1, pp. 2–4*).—The author reports the occurrence of the common dodder (*Cuscuta europæa*) on sugar beets in western Hungary.

Lectures to sugar planters (*Imp. Dept. Agr. West Indies, 1906, pp. VII+176, figs. 65*).—This publication contains lectures on the following subjects: The natural history of the sugar-cane, by D. Morris; soils and manures in relation to the cultivation of the sugar-cane, by J. P. D'Albuquerque; hints on the planting and cultivation of the sugar-cane and intermediate crops, by J. R. Bovell; the insect pests of sugar-cane and associated crops, by H. Maxwell-Lefroy; and the fungoid diseases of the sugar-cane, by A. Howard.

Report of the division of agriculture and chemistry, C. F. Eckart (*Hawaiian Sugar Planters' Sta. Rpt. 1906, pp. 21–42, figs. 6*).—A general report is here given on the work of this division for the year ending September 30, 1906. The different lines of work in progress are briefly outlined and experiments soon to be inaugurated are described.

Observations on seed-bearing sugar canes and the production of seedlings are discussed and the number of seeds of different varieties germinating and the number of plants successfully raised are given in a table. During the season 5,232 seedling canes were grown. Of 279 plants raised from West Indian seed imported in 1904, 37 have been sufficiently promising to merit special testing on the station grounds.

Tobacco culture on soils which had been reforested with Albizzia moluccana (*Meded. Deli-Proefstat. Medan, 1 (1907), No. 2–3, pp. 61–114*).—The results of different cooperative tests indicate that reforesting with *Albizzia moluccana* on the various kinds of soils under observation is not injurious to tobacco land as is commonly supposed. The method has the advantage of reducing hard soils.

The selection of seed wheat, G. W. Shaw (*California Sta. Bul. 181, pp. 149–172, figs. 12*).—This bulletin treats of the importance of seed wheat selection and describes the methods employed. A large number of samples of seed wheat were obtained over a wide area in the Sacramento and San Joaquin valleys of California for the purpose of determining the general character of

the seed used by the farmers of the State. The results secured are given in detail in tabular form. The work done at various experiment stations in selecting seed wheat is summarized.

The samples graded by the station consisted mainly of White Australian, Salt Lake Club, Bluestem, and Sonora Wheat. Comparative results of the standard, average, and poorest samples graded are given in the following table:

Comparative grading of standard, average, and poorest samples of wheat used for seed, 1904–1906.

Sample.	Grades according to size of mesh.							Weight per bushel.
	3.25 mm.	3.00 mm.	2.75 mm.	2.50 mm.	2.25 mm.	2.00 mm.	Trash.	
Salt Lake Club:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Pounds.*
Standard	3.90	13.00	24.20	50.80	4.10	1.00	2.60	60.0
Average (2 years)	1.66	3.92	12.09	51.17	17.14	6.13	6.26	57.0
Poorest	.00	.00	.85	11.34	33.50	32.13	22.16	44.5
White Australian:								
Standard	28.61	18.49	28.74	19.62	1.83	1.93	.75	60.5
Average (2 years)	6.56	8.23	22.16	47.20	9.74	2.19	3.84	57.7
Poorest	.00	.00	.90	49.12	40.22	6.02	3.79	53.0
Bluestem:								
Standard	43.66	22.29	20.95	10.71	.91	.62	.83	61.0
Average (2 years)	9.45	10.19	21.82	38.71	7.93	2.01	1.99	58.5
Poorest	.00	.00	.00	7.15	59.21	22.98	10.70	46.2

In general the samples showed that the quality of seed used by most farmers is lacking in purity, perfection of development, weight per bushel, freedom from weeds, and freedom from bunt. Attention is called to the fact that practically all investigators have found the use of large, plump seed of high weight per bushel the most profitable. No permanent benefit is believed to be secured from the frequent exchange of seed unless a better type of wheat or a more vigorous grain of the same type is obtained by the exchange. The most important points to be considered in seed selection are the use of seed from heavy yielding plants, a plump and heavy grain, a clean wheat, and a pure variety.

HORTICULTURE.

Japanese horticulture, N. Hayashi (*Jour. Roy. Hort. Soc.* [*London*], *31* (*1906*), *pp. 18–28*).—The author outlines the history of the development of horticulture in Japan, and briefly discusses the facilities for obtaining horticultural knowledge in that country. A summary is given of over 100 kinds of fruits, vegetables, and nuts, both of native and foreign origin, now grown in Japan, with an account of the origin and economic importance of each.

Summary of results with vegetables and fruits at the North Louisiana Experiment Station from 1892 to 1907, E. J. Watson (*Louisiana Stas. Bul. 90, pp. 47*).—The author summarizes the results of his horticultural work at the North Louisiana Station from 1892 to 1907. The subject-matter is presented under the following headings: Results with vegetables, results with fruits, and condensed information on canning fruits and vegetables.

The work for the last 3 seasons has been devoted chiefly to experiments in commercial truck growing and canning of the surplus vegetables and fruits. Tests have been made with all of the well-known vegetables, the most promising of which are discussed in detail with regard to best varieties, time of seed sowing, the average period from seed planting to marketable maturity, the yields, and prices obtained for those crops that were marketed. For several years experiments were conducted on the relative value of home-grown commercial seed (E. S. R., 14, p. 249).

Under results with fruits the data on variety and fertilizer tests are given, together with the period of blooming and ripening of the fruit. The author states that the data secured on fruits during the past 14 years are not very favorable since the climate is not adapted to the successful culture of many of the fruits reported upon, except to a limited extent. Condensed notes are given on the canning of fruits and vegetables, including a discussion of the advantages of home-canning, and brief remarks on the most profitable sorts for canning, including tomatoes, string beans, sweet corn, sweet potatoes, peaches, berries, and cane syrup. A homemade canning outfit is described, which can be built at a cost not exceeding $40. A preliminary report on the experiments in truck growing and canning has been noted (E. S. R., 17, p. 364).

Tomato fertilizers at Troupe, W. S. HOTCHKISS and E. C. GREEN (*Texas Sta. Bul. 84, pp. 15, figs. 6*).—An account of fertilizer experiments and variety tests with tomatoes at the Troupe Station during the seasons of 1904 and 1905.

The fertilizer ingredients used included cottonseed meal, muriate of potash, acid phosphate, wood ashes, cow manure, nitrate of soda, lime, and tankage, either alone or in combinations. Beauty, Acme, and Earliana were the varieties tested. Tables are given showing the yield of marketable and unmarketable fruit gathered at each picking from the different fertilizers and varieties used. The experiments were conducted on soil composed of a very fine gray sand, running from 8 to 18 in. in depth and underlaid with a red clay soil.

The use of potash, either in the form of muriate of potash or wood ashes, alone or in combination, was found to be unsatisfactory. The use of large quantities of lime alone appeared to be injurious. Nitrate of soda, which was also tried in 1903, was abandoned after the 1904 experiment, as this form of nitrogen gave no better result than in the form of cotton-seed meal.

Cow manure gave fairly good results, but the largest and earliest yields were obtained from the use of acid phosphate alone on new lands comparatively rich in humus, and acid phosphate in combination with cotton-seed meal on old lands deficient in humus and fertility. For soils similar to that at the station the authors suggest the following formula: Acid phosphate 1,200 lbs. and cotton-seed meal 800 lbs., using from 400 to 600 lbs. per acre of the mixture.

Earliana produced the largest quantities of early tomatoes, and is recommended as a variety for early shipments. The authors, however, do not recommend it as compared with Acme or Beauty for a general purpose variety.

Money in cucumbers, W. DUNN (*Amer. Agr., 1907, Feb. 9, p. 166*).—The author, who is a truck grower in Craven county, North Carolina, states that he recently realized $4,000 from 7 acres of cucumbers, which after deducting a total expense of less than $100 an acre, left him over $3,000 net profit.

The artichoke, R. F. LE FEUVRE (*La Alcachofa. Santiago de Chile: Inst. Agr. Chile, 1906, pp. 120, figs. 26*).—A monograph on the artichoke *Cynara scolymus*, known in this country as the Globe artichoke and valued for its edible flower heads and petals. The cardoon (*C. cardunculus*) an allied form, is classed with the artichoke in this publication.

The work includes a discussion of the origin, general importance, climatic adaptation, and cultivated varieties of the artichoke in various countries, and gives specific directions for its propagation, cultivation, and harvesting in Chile, together with the products, their uses and methods of preservation. An extensive bibliography of the artichoke is also given.

Cultivation of fruit trees, L. BUSSARD and G. DUVAL (*Arboriculture Fruitière. Paris: J. B. Baillière & Sons, 1907, pp. 562, figs. 188*).—This volume is one of the series which constitute the agricultural encyclopedia published under the direction of G. Wery.

The book is intended as a treatise on the cultivation of tree fruits for both amateur and professional growers in France. Part 1 is introduced by chapters discussing the importance and distribution of fruit orchards in France, and a study of the morphology, anatomy, and physiology of fruit trees and their fruits. Succeeding chapters deal with all the important phases of fruit culture, including methods of propagation, the laying out, and management of different forms of fruit gardens and orchards, the preparation and fertilizing of the soil, planting, and subsequent care. This part is concluded by an extensive chapter on pruning.

Part 2 deals with each of the important species of fruit, treating of their characteristics, processes of multiplication, pruning, special requirements, harvesting, and utilization of the products. Descriptions are also given of the important varieties of each species.

Peculiar seedless apple, F. Herse (*Naturw. Wchnschr., 22 (1907), No. 5, p. 72, figs. 4*).—A description is given of a seedless apple secured at harvest time from a country orchard in Germany, together with figures representing the external appearance of the apple and vertical and horizontal sections.

The apple is rather peculiar in appearance, since both halves appear fully and evenly developed from one side, but when turned around it is seen to be much broader at the calyx end than at the stem end. A study of the sections shows that the dividing walls of the core are absent, whereas the endocarp is present as in normal apples.

The alligator pear at Pomona, Los Angeles County, California (*Fla. Agr., 34 (1907), No. 6, p. 2*).—This is a brief note taken from the Pomona Review, which states that an alligator pear (avocado) tree was planted from seed in Pomona some 10 years ago and has continued to thrive without special attention. During the past season 14 large pears were gathered, which sold in the Los Angeles market for $10. The avocado is not generally considered hardy in that region.

Standard sizes of fruit boxes (*Pacific Rural Press, 73 (1907), No. 4, p. 50*).—A list is given of the standard sizes of California fruit packages for shipping purposes, including the dimensions and the amount of fruit contained in each for cherries, peaches, pears, pears for export to Europe, plums, prunes, apricots, nectarines, grapes in single crate, and grapes in double crate.

The uses of the sakoa, Tralboux (*Agr. Prat. Pays Chauds, 7 (1907), No. 46, pp. 79, 80*).—This is a note on the sakoa, a native fruit of Madagascar, the tree of which is said to have the appearance of an apple tree and to be very prolific. The fruit is about the size of a plum, yellowish in color, and very acid. The natives gather it from the trees in January, February, and March. The pulp is chewed by the natives to quench thirst, and is an important source of food in dry seasons when crops fail. The fruit is also utilized in making fermented beverages and in dyeing. The bark of the sakoa tree is said to be rich in tannic acid.

Pineapple culture V. History and bibliography, H. H. Hume (*Florida Sta. Rpt. 1906, pp. XXXIV–LXIV, figs. 3*).—This is the fifth of a series of bulletins on this subject. In the 4 preceding bulletins (E. S. R., 17, p. 1155) soils, varieties, results of fertilizer experiments, and the methods of harvesting, grading, packing, and shipping were discussed.

In this bulletin an account is given of the history and origin of the pineapple, together with its introduction into Europe and its early Florida history. It is said to be a native American fruit. The author mentions numerous early writers on the subject, and gives an extensive bibliography of the books, magazine articles, reports, and bulletins dealing with the pineapple.

Second note on the wild coffees of Mount Amber, Madagascar, M. DUBARD (*Agr. Prat. Pays Chauds, 6 (1906), No. 45, pp. 518-521, figs. 2*).—In the first notes on this subject (E. S. R., 16, p. 976) the author describes 3 wild varieties of coffee found on Mount Amber, Madagascar, viz. *Coffea gallienii*, *C. bonnieri*, and *C. mogeneti*. In the present note he adds further remarks on these 3 varieties and describes a new variety which he has received from Madagascar called *C. augagneuri*. This variety is said to be well characterized in the form of its leaf and the peculiarity of its fruit.

The cocoanut, P. HUBERT (*Le Cocotier. Paris: H. Dunod and E. Pinat, 1906, pp. XIV+135, figs. 39*).—Cocoanut cultivation, insect enemies, and related questions are discussed, as well as the manufacture and use of copra, desiccated cocoanut, cocoanut oil, and other cocoanut products.

The practical culture of cacao trees, A. FAUCHÈRE (*Paris: A. Challamel, 1906, pp. 175, figs. 40*).—This is a treatise on the culture and preparation of cacao for the market, with special reference to the development of the industry in Madagascar. The work is based on methods in vogue in Central America, the Antilles, Ecuador, Venezuela, Trinidad, the Guianas, Brazil, and Mexico, and deals with the natural distribution, history, species and varieties in use, climatic and soil adaptabilities, animal and insect enemies, and the important phases of culture and management.

Estimates are given of the cost of planting, cultivating, and maintaining cacao plantations both under personal supervision and by contract for a period of 10 years. The processes of fermentation, drying, and preparing the cacao fruit for the market, together with the apparatus pertaining to these processes, are discussed in full. Two appendixes are included in the work, which deal with the importance of cacao culture and special suggestions for the management of the plantation with reference to Madagascar. The work is illustrated by numerous figures.

The yucca, R. J. FOSALBA (*Bol. Agr. [San Salvador], 6 (1906), No. 12, pp. 579-596*).—This is a reproduction of the author's report to the minister of foreign relations of Uruguay on the relative importance and uses of the yucca in the West Indies, Mexico, South America, Florida, and Java. It consists of a collection of notes on the uses and present status of the yucca industry in the different countries mentioned, together with a description of the cultivation of this plant in Cuba.

Some of the important products of the yucca are starch, alcohol, tapioca, and yucca flour. The starch is considered in Cuba to be of superior quality to all imported starches. As a flour, yucca is inferior to wheat, but is of great importance to natives of the poorer classes in the West Indies when they are unable to purchase other foods. A bibliography is given, including the various sources from which the author derived information.

The influence of cold in horticulture, A. H. PERRET (*Rev. Sci. [Paris], 5. ser., 7 (1907), No. 6, pp. 170-174*).—The author discusses the utilization of cold storage in retarding the blooming period and the preservation of blooms of commercial flowering plants, bulbs, and shrubs. A brief account of the harvesting, grading, storing, and forcing of lilies of the valley and flowering bulbs near Hamburg, Germany, is given, together with recent experiments of M. J. Mercier, of Dijon, on the influence of cold storage in the preservation of cut flowers.

In these experiments two cold-storage mediums were used, an ice house and an artificial cold-storage room. The ice house had a temperature of about 2° C. with a relative atmospheric humidity of 90 parts per 100, while the temperature of the cold-storage room was about 5° C. with a relative humidity of 60 parts

per 100. A great variety of cut flowers were tested by being stored in vases half filled with water, and notes are given on the behavior and length of preservation of each variety. Storing in the ice house with a lower temperature and a relatively great amount of humidity gave by far the better results.

The conclusion is reached that the most suitable temperature for the storing of cut flowers is just above 0° C. (32° F.), where the active growth is checked without destroying cell life, and that the flowers should be stored in a relatively humid atmosphere in order to check the evaporation of the blooms. Careful attention, however, must be paid to ventilation, since a close, humid atmosphere is favorable to the production of molds and fungus diseases. The storage room should be dark and the leaves should be removed to reduce danger from putrefaction.

Progress in hybridization and plant culture, L. WITTMACK (*Gartenflora, 56 (1907), Nos. 1, pp. 2–14; 2, pp. 31–37, figs. 4*).—This is a paper delivered by the author before the Prussian Society for the Advancement of Horticulture, and consists essentially of a historical review of the various steps in the development of plant breeding. Concrete examples of crosses and their effects as made between different varieties of Urtica, four o'clocks (*Mirabilis jalapa*), Indian corn, gilly-flowers, and sweet peas are introduced in order to emphasize different phases of the discourse.

Seven gardens costing $1,000 each, HARRIET C. BRYANT (*Country Life Amer., 11 (1907), No. 5, pp. 528–532, dgms. 7*).—The author presents planting plans and specifications of 7 gardens designed for country and suburban places and intended to provide an ample supply of fruits, vegetables, and flowers, as well as attractive landscape pictures. The details and cost of each phase of construction and planting are given, together with the common and standard names, ultimate height, and the number of plants used of each variety recommended. The plans are illustrated.

The garden beautiful, W. ROBINSON (*London: John Murray, 1906, pp. 394*).—In this popular work the author emphasizes the æsthetic and artistic phases of woodland, garden, and orchard culture in the British Isles. Its aim, given in substance, is to create a greater love for the natural woodland and the more extensive use of native trees and flowers.

Numerous suggestions are made as to the planning and making of various forms of flower gardens, including Alpine, rock, wall, marsh, bog, and water gardens, the care and arrangement of house flowers, and the artistic development of fruit orchards, home woodlands, and forest plantings. Throughout the work many varieties are enumerated and discussed as to their value for these various forms of planting.

Practical suggestions for improving and beautifying rural school grounds, T. H. SCHEFFER (*Industrialist, 33 (1907), No. 15, pp. 227–240, fig. 1*).—Popular suggestions are made on this subject dealing with the selection of site, location of school grounds and buildings, walks, driveways, fencing, grading, and development of playgrounds, lawns, and planting of shrubs, trees, and flowers. A sample planting plan for the rural schoolhouse is also given.

The history of chrysanthemum cultivation in Japan, N. HAYASHI (*Jour. Roy. Hort. Soc.* [*London*], *31 (1906), pp. 29–39, figs. 7*).—Several forms of chrysanthemums are discussed, and descriptions are given of the successful methods of cultivating chrysanthemums as used by amateurs in Japan. The author states that the usual methods employed by nursery gardeners in Japan are very similar to those pursued in this country.

Horticulture in relation to medicine, E. M. HOLMES (*Jour. Roy. Hort. Soc.* [*London*], *31 (1906), pp. 42–61, figs. 8*).—This is a popular lecture on the use

and culture of plants for medicine, both in ancient and modern times, in which all of the important herbs employed for medicinal plants are considered. The author refers to the publications of numerous members of the medical profession who have been active in encouraging the production and cultivation of medicinal plants. A list is given of the herbs most commonly used in England for medicinal purposes.

FORESTRY.

Management of the farmer's woodlot, W. N. Hutt (*Cornell Countryman, 4 (1907), No. 5, pp. 128–134, figs. 3*).—The author outlines the practical management of the ordinary farm woodlot for the purpose of making it a useful and permanent asset of the farm. Several varieties of trees suitable for this form of planting are given.

A preliminary working plan for the public forest tract of the Insular Lumber Company, Negros Occidental, Philippine Islands, H. D. Everett and H. N. Whitford (*[Philippine] Bur. Forestry Bul. 5, pp. 54, figs. 12, map 1*).—This work has been prepared to furnish a prescribed plan for the regulation and management of the large tract of public forest granted to the Insular Lumber Company for a period of 20 years, as well as to secure accurate information concerning the timber of this important forest region of the Philippine Islands and to give the native rangers of the bureau training in forest field work. The field work consisted of mapping, botanical surveys, and collection of data for forest management.

Part 1 is a statement of the facts upon which the working plan is based and deals with the general description of the tract, composition and condition of the forest, a description of the principal species of trees, and the utilization of the forest. Historical remarks are given on the development of lumber in this province, together with an account of the present lumbering operations, including remarks on markets, transportation, prices and government charges, prospects, and agricultural possibilities of the land.

Part 2 deals with the future management of the tract, treating of the basis of proposals, method of working the forest, and supplementary recommendations.

In an appendix a list is given of the species of trees mentioned in the text, including the scientific, family, common, and commercial names. A map of the working plan under discussion accompanies the bulletin.

A preliminary working plan for the public forest tract of the Mindoro Lumber and Logging Company, Bongabon River, Mindoro, Philippine Islands, M. L. Merritt and H. N. Whitford (*[Philippine] Bur. Forestry Bul. 6, pp. 55, pls. 14, map 1*).—The work upon which this report is based was undertaken for the purpose of forming a preliminary plan of management to be put into operation pending more complete investigation. The tract was inspected, surveyed, and mapped and notes taken on the distribution of the different types of vegetation.

Part 1 is a statement of the facts upon which the working plan is based. A general description of the tract is given, together with the composition and condition of the forest, the characteristics of various types of timber and descriptions of species, injuries to which the forest is liable, the development of the lumbering industry on this tract, and the present lumbering operations, markets, transportation, financial results, and prospects.

Part 2 deals with the future management of the tract. In an appendix is given a list of the few species found on the tract that reach the size of 30 cm. in diameter, together with a list of all the other species mentioned in the text, including the scientific, family, local, and commercial names of each. A map of the working plan accompanies the text.

Financial results of forest management, B. E. FERNOW (*Forestry and Irrig., 13 (1907), No. 2, pp. 81–86, fig. 1*).—The author traces the progress and presents data as to financial results of Saxon and Prussian forestry administrations. The Saxon forestry area is said to be comparable to New England conditions and the Prussian areas to the conditions existing in our southern pineries and the forests of the Middle Atlantic and Central States. The following are the net returns realized per dollar of expenditure at 3 different periods in Saxony and Prussia, respectively: In 1850, $1.51 and $1.25; 1880, $2.00 and $1.05; 1904, $1.77 and $1.66.

The author believes that much better results can be secured from our own forests providing we take advantage of the hundred years of mistakes and successes in forestry administration in foreign countries.

Annual report of the director of forestry, fiscal year 1906, G. P. AHERN (*[Philippine] Bur. Forestry Rpt. 1906, pp. 27, pls. 16*).—An account of the organization of the bureau and forest districts, field work in the different districts, and laboratory tests. In an appendix a summary is given of the list of licenses issued, amount of timber cut under licenses granted during 1905 and 1906, the utilization of forest products from public lands on which government charges have been collected, the applications for permits to make forest clearings, applications for homestead, purchase, and lease of public lands, imports and exports of timber and other forest products into the Philippine Islands, and of appropriations, expenditures, and revenues for the Bureau of Forestry since its organization.

Tests were made with a large number of Pacific-coast timbers to determine their resistance against attacks of anay (white ant) and of decay. The timber was divided into three series. Series A was untreated and served as a check, series B was treated with mercuric chlorid, and C with creosote. As a result of this experiment it was determined that only untreated woods suffered from the attack of the ant. Fungus diseases had not thus far developed in any case.

In a test of ropes made by home and foreign manufactures, it was shown that rope manufactured in Hongkong and the United States was superior to that manufactured in the islands. This superiority is believed to be due to modern methods of manufacture and the use of high-grade hemp.

The Michigan forestry convention, J. HILDER (*World To-Day, 12 (1907), No. 2, pp. 209–211, figs. 3*).—The chief purpose of the Michigan Forestry Association is said to be to secure the reforestation of cut-over timber lands of no value for general agricultural purposes.

It is hoped that this can be secured by the enactment of laws providing for adequate protection from the fires which yearly sweep over the cut-over lands, for a rational system of taxation under which the trees will be considered as a crop to be taxed when harvested instead of yearly with the land, for the abolition of the homestead law, and the exacting of a minimum price of $5 an acre for all State lands in order to prevent real estate speculation with these lands. If these laws can be obtained, it is believed that owners will be encouraged to allow the trees to grow until maturity instead of cutting them down when they are large enough to make fence posts.

How to cultivate and care for forest plantations on the semiarid plains (*U. S. Dept. Agr., Forest Serv. Circ. 54, pp. 4*).—This leaflet gives concise instruction for the preservation and maintenance of soil moisture in forest plantations in semiarid regions. The proper distance to space trees for continued cultivation, mulching, tools, and methods of cultivation are dealt with. The planting of crops between trees is said to be unwise, since the trees are deprived of available moisture. The planter is cautioned to afford proper protection against grazing and fire

Pictorial practical tree and shrub culture, W. P. WRIGHT and W. DALLIMORE (*New York and London: Cassell & Co., Ltd., 1905, pp. 152, figs. 28*).—This book is an illustrated practical manual giving concise directions for the propagation, planting, pruning, and general management of trees and shrubs. The subject-matter is chiefly the work of William Dallimore and is edited by W. P. Wright.

Several chapters are devoted to the use of trees and shrubs for forcing, for the colored foliage, ornamental green leaves, autumn tints, ornamental fruits, ornamental stems, climbing and trailing plants, evergreens, for undergrowth and shade, hedges, and as pendulous plants. Short descriptions are given under each chapter of many of the best trees and shrubs for each of these purposes. There are also lists of the best trees, conifers, and shrubs in alphabetical order.

The importance of selecting seed in practical forestry, G. F. SCOTT-ELLIOT (*Jour. Roy. Hort. Soc. [London], 31 (1906), pp. 147–150*).—A discussion of the experiments carried out by Prof. Adolf Engler in Zurich, in which seeds of picea, pinus, sycamore, and larch were obtained from trees growing at different altitudes and then sowed in experimental gardens at altitudes ranging from 500 or 600 meters to 2,000 meters.

It was demonstrated from these experiments that trees of very high altitudes have developed the habit of forming their annual growth in a much shorter time than trees in lower altitudes and that their seed is not suitable for culture in low altitudes, but is probably the best to plant in the altitudes where the parents were produced. Large seeds, whatever their origin, produce on the whole larger and heavier plants than smaller ones.

How to transplant forest trees (*U. S. Dept. Agr., Forest Serv. Circ. 61, pp. 4, fig. 1*).—This leaflet gives concise instructions for the careful transplanting of forest trees, both in nursery rows and in the field, together with the proper season for transplanting.

How to pack and ship young forest trees (*U. S. Dept. Agr., Forest Serv. Circ. 55, pp. 2, fig. 1*).—Detailed directions are given for the careful handling and packing of young forest trees, with the view of affording proper ventilation and at the same time preventing the roots from drying out.

Forest planting leaflets (*U. S. Dept. Agr., Forest Serv. Circs. 56, pp. 3; 57, pp. 2; 58, pp. 3; 60, pp. 3; 62, pp. 3; 63, pp. 3; 64, pp. 4; 65, pp. 4; 66, pp. 3; 67, pp. 6; 68, pp. 4; 70, pp. 3; 71, pp. 4; 72, pp. 2; 73, pp. 4; 74, pp. 3; 75, pp. 3*).—These are a series of leaflets which treat of the form and size, range, habits, growth, economic uses, methods of propagation, planting, and subsequent care of the following species of forest trees, given in order corresponding to circular numbers above: Bur oak (*Quercus macrocarpa*); Jack pine (*Pinus divaricata*); red oak (*Quercus rubra*); red pine (*Pinus resinosa*); shagbark hickory (*Hicoria ovata*); basswood (*Tilia americana*); black locust (*Robinia pseudacacia*); Norway spruce (*Picea excelsa*); white elm (*Ulmus americana*); white pine (*Pinus strobus*); Scotch pine (*Pinus sylvestris*); European larch (*Larix europæa*); chestnut (*Castanea dentata*); western yellow pine (*Pinus ponderosa*); red cedar (*Juniperus virginiana*); honey locust (*Gleditsia triacanthos*); and hackberry (*Celtis occidentalis*).

Eucalypts (*U. S. Dept. Agr., Forest Serv. Circ. 59, pp. 6*).—This leaflet treats of the blue gum (*Eucalyptus globulus*), red gum (*Eucalyptus rostrata*), and sugar gum (*Eucalyptus corynocalyx*), with respect to their form and size, range, silvical qualities, economic uses, methods of propagation, planting, subsequent care, and their use as wind-breaks. The estimated total cost of a eucalyptus plantation, excluding land rent, at the end of 12 years is $36.86 per acre, with a probable gross income of $180.

The Franquette walnut, M. McDonald (*Pacific Rural Press, 73 (1907), No. 7, pp. 100*).—The author discusses the value of the Franquette walnut as compared with other French varieties for planting in Oregon.

Figures are given showing the increase in yield of a Franquette grove at Santa Rosa, California, from the time the trees were 3 years old in 1901 until they were 8 years old in 1906. During this period the total yield increased from 82 lbs. to 24,314 lbs., and the output practically doubled for each year after 1902.

The chilté tree, Costantin and Gallaud (*Rev. Gén. Bot., 18 (1906), No. 214, pp. 385–391, figs. 2*).—An account, including the method of exploitation and an illustrated botanical description, is given of the chilté tree of Mexico, for which the authors propose the name of *Jatropha tepiquensis*. The seeds are used as food in Mexico and the gum is said to have taken the place of chicle (E. S. R., 17, p. 257) in the manufacture of American chewing gum.

The culture of Ficus elastica (*Bul. Off. Gouvt. Gén. Algérie, 1907, Sup. 1, pp. 18*).—This work treats more particularly of the species of Ficus adapted for the production of rubber. The characteristics which differentiate the *Ficus elastica* from *F. magnolioides* are pointed out.

The manurial requirements of rubber trees (*Trop. Life, 3 (1907), No. 1, pp. 3–5, figs. 4*).—Popular directions are given for the use of commercial fertilizers in the culture of rubber trees.

What I saw in the Tropics, H. C. Pearson (*New York: India Rubber Pub. Co., 1906, pp. 296, figs. 289*).—The author relates his personal experiences and adventures during visits to Ceylon, the Federated Malay States, Mexico, Nicaragua, Costa Rica, Republic of Panama, Colombia, Jamaica, and Hawaii. Considerable information concerning the present status of the rubber industry and the various species and varieties under cultivation in these countries is given.

Resinous secretions and resin ducts, A. Tschirch (*Die Harze und die Harzbehälter. Leipsic: Borntrager Bros., 1906, vols. 1, pp. XXII + 1902; 2, pp. 1093–1268, figs. 104*).—Volume 1 is a chemical study of resinous secretions and their products. Volume 2 consists of a botanical study of the ducts which contain these resinous secretions. Under resinous secretions the author includes the saps of coniferous, euphorbias, and all rubber-producing trees. The treatise is based on extensive researches of the author and several collaborators, together with information secured from many scientific works.

Effect of moisture upon the strength and stiffness of wood, H. D. Tiemann (*U. S. Dept. Agr., Forest Serv. Bul. 70, pp. 144, pls. 4, figs. 25*).—This bulletin is a report of a series of tests conducted by the Forest Service in conjunction with the Yale Forest School under the direct supervision of the author. All of the important features of the work are discussed in detail and the results are set forth in numerous tables, figures, plotted curves, and plates.

Besides the main tests, which include the important phases of compression parallel to grain, bending, shearing, and compression at right angles to grain, special tests were made to determine other closely related problems such as the fiber-saturation point, the effect of temperature upon this point, the effect of steaming and boiling, of time of soaking, and of casehardening, and the determination of volatile oils. In all, the report includes over 1,600 mechanical tests and nearly three times as many moisture determinations were made.

Three species of wood were studied and compared. Longleaf pine (*Pinus palustris*) and red spruce (*Picea rubens*) were used as representative coniferous woods, and the chestnut (*Castanea dentata*) as representative of the ring-porous woods. The test specimens were made of the size considered the most satisfactory for experimental purposes, viz, of 2 by 2 in. stuff of different lengths. The results apply especially to the smaller forms of hard and soft

wood material which can be thoroughly and uniformly dried, such as carriage stock, cross-arms for telegraph poles, etc. The author states that the designs of structures should be based on the unit strengths which have been derived from actual tests of large sticks in the condition in which they are to be used.

Drying was found to produce a remarkable increase in the strength, stiffness, and elastic limit of the wood. The effect of dryness upon the shearing strength parallel to the grain is a variable quantity which can not be relied on. Soaking in cold water does not diminish the strength of the wood beyond the point at which the wood fiber becomes saturated. This point the author calls the fiber-saturation point, which is described in substance as follows: Upon immersing a piece of dry wood in water the water is gradually drawn into the pores and also absorbed by the walls of the wood substance. As the latter absorbs more and more water the strength continues to decrease until the point is reached where the walls are saturated and will hold no more. This is the fiber-saturation point and although more water may be taken up by the pores the strength of the wood does not diminish beyond this point, which may also be termed the point at which swelling ceases. Heating the water, however, gradually reduces the strength, since the wood fibers become more fully saturated. Wood that has been dried and remoistened is weaker than wood of an equal degree of moisture which has not been dried. This weakened effect is most marked in the case of steaming at high pressure and is less obvious where the wood is dried slowly at a low heat.

In the introduction to the bulletin W. K. Hatt states, in substance, that as a result of these investigations there have been fully determined the factors by the use of which the results of tests at different degrees of moisture may be reduced to an equal basis in the case of certain species and certain kinds of tests, thereby establishing a percentage of moisture at which the cell walls are saturated in the case of these species, and determining the true nature of the law representing the effect of any further reduction of moisture on the strength of timber. The subsidiary studies in connection with the work, such as casehardening, prolonged soaking, and soaking followed by drying, are believed to have direct application to the technology of various products and to be of great value to students and engineers.

Two appendixes follow the main subject-matter. Appendix A treats of the formulas used in the calculations and describes special studies and subordinate investigations in connection with the work. Appendix B is a discussion of the microscopic study of the fractures produced in the woods by the various tests.

Mechanical tests, properties, and uses of thirty Philippine woods; Philippine sawmills, lumber market, and prices, R. GARDNER ([*Philippine*] *Bur. Forestry Bul. 4, pp. 69*).—This bulletin was prepared to meet inquiries concerning the Philippine woods and milling operations in the Philippines. Tabulated data are given showing the results of tests in cross bending, compression, shear tests, and moisture determinations. These results are also illustrated by several linear curves. The different species tested are discussed as to their structural qualities, appearance, uses, provinces leading in production, sizes, and common and botanical names.

Part 2 gives an account of the present condition of the sawmill industry in the Philippines, together with a discussion of the lumber market and prices.

Wood production and commerce in Europe, Africa, and North America, J. MARCHET (*Holzproduktion und Holzhandel von Europa, Afrika, und Nord-Amerika. Vienna: W. Frick, 1905, pp. 459*).—Statistical data are given showing the timber production of different important timber-producing countries of the world for a number of years up to 1904, and in many instances of the timber imports and exports of the different countries.

Rules and specifications for the grading of lumber, E. R. Hodson (*U. S. Dept. Agr., Forest Serv. Bul. 71, pp. 127*).—This bulletin contains an enumeration of the rules and specifications for the grading of lumber as adopted by the various lumber manufacturing associations of the United States. A historical account is given of the development of grading in this country, including descriptions of the 4 grades of lumber into which white pine was originally classified. The States having inspection laws are also noted.

Fence-post trees (*U. S. Dept. Agr., Forest Serv. Circ. 69, pp. 4*).—This is a forest planting leaflet giving brief instructions for the planting, cultivation, and care of fence-post plantations, with a list of the best species for this work, as follows: Chestnut, European larch, catalpa, black locust, Osage orange, and Russian mulberry. The economic planting range and suitable soils for each of these species are given.

Examinations of larch plantations in Illinois, Iowa, and eastern Dakota, and hardy catalpa plantations in Illinois, indicate that the returns from fence-post plantations are approximately as great as from field crops. In order to emphasize the importance of selecting well-prepared, fertile soil, the financial returns from 2 hardy catalpa plantations are given. Plantation No. 1 was on a well-prepared, virgin prairie soil; No. 2, on adjacent worn-out farm land. At the end of 14 years No. 1 yielded a net profit of $170.50 per acre in the value of fence posts cut, whereas plantation No. 2 at the end of 15 years yielded a net profit of only $3.54 per acre. Both of these plantations received cultivation and pruning at the proper time.

Prolonging the life of mine props (*Forestry and Irrig., 13 (1907), No. 1, pp. 43, 44, figs. 2*).—In experiments which have been recently conducted by the Philadelphia and Reading Coal and Iron Company at its collieries near Pottsville, Pa., under direction of the Forest Service, it has been demonstrated that the preservation of mine props can be put upon a firm commercial basis. The principal preservatives used are creosote and carbolinium, which have been found to be successful both when applied with a brush and in the open-tank treatment. It is believed that the cost may be reduced still further when more is known as to the length of time necessary for immersion. The experiments have been mainly on loblolly pine, the wood most used for mine props.

Wood used for tight cooperage stock in 1905, H. M. Hale (*U. S. Dept. Agr., Forest Serv. Circ. 53, pp. 8*).—This circular is a compilation of statistics on the annual production of tight cooperage stock in the United States and is based on statements of 220 manufacturers. The statistics are compiled in 9 tables, with the important features explained. They show the quantity and value in 1905 of tight cooperage stock, sawed staves, bucked and split staves, hewed staves, sawed heading, etc., used in the manufacture of barrels for oil, distilled spirits, wine, ale, beer, pork, etc. In some instances the production of the different kinds of stock is given by States.

DISEASES OF PLANTS.

Some bacterial diseases of plants, G. Delacroix (*Ann. Inst. Nat. Agron., 2. ser., 5 (1906), No. 2, pp. 353–368, figs. 4*).—Descriptions are given of the canker of poplars due to *Micrococcus populi*, a bacterial disease of potatoes caused by *Bacillus phytophthorus*, and a bacterial disease of onions attributed to *Bacillus cepivorus*. These diseases have been previously noted (E. S. R., 18, p. 551.

The principal fungus diseases of the year, T. W. Kirk (*New Zeal. Dept. Agr. Ann. Rpt., 14 (1906), pp. 341–365, pls. 13*).—Descriptive notes are given on a number of fungus diseases which have been observed during the year, together

with suggestions for their control. The different diseases are grouped according to the host plants under the following heads: Field crops, grasses, garden plants, vegetables, and fruit trees.

Report of assistant in botany and horticulture, H. S. FAWCETT (*Florida Sta. Rpt. 1906, pp. XXI–XXVII*).—Notes are given on a number of diseases of plants that have been under observation during the past year, and a brief account of a study of the fungus parasites of the white fly, which is proving very destructive in orange groves. Among the more important plant diseases noted are anthracnose and wilt of beans, leaf blight of cantaloupes, rust of celery, scab and wither tip of citrus fruits, cucumber mildew, mango bloom blight, peach crown gall, and tomato leaf blight, leaf mold, wilt, and bacterial blight. For the prevention of most of these diseases thorough spraying with Bordeaux mixture has proved successful.

Annual report of investigations on plant diseases, M. HOLLRUNG ET AL. (*Jahresber. Pflanzenkrank., 8 (1905), pp. VIII+340*).—This report, published in 1907, gives a review of the literature relating to plant diseases and insect injuries issued during 1905, about 2,200 articles being noted by abstract or otherwise. The arrangement of the topics is essentially the same as that previously given (E. S. R., 12, p. 658).

Root diseases of sugar beets, L. PETERS (*Umschau, 11 (1907), No. 5, pp. 85–87, figs. 4*).—The author describes diseases of sugar-beet seedlings due to *Pythium debaryanum*, *Phoma betæ*, and *Aphanomyces lævis*. The methods of attack and the effect upon the host plants are described, after which notes are given on the prevention of these diseases, the means suggested including treatment of the seed with fungicides, soil treatments, etc.

The occurrence of alumina and iron oxid in diseased beets, H. PELLET (*Sucr. Indig. et Colon., 69 (1907), No. 5, pp. 118–120*).—In his investigations regarding the bacteriosis of sugar beets (E. S. R., 12, p. 458) Stift has shown that as a result of disease the ash content as well as the proportion of iron oxid and alumina are increased

The author has reviewed the experiments of Stift and carried on investigations with beets attacked by the heart rot (*Phoma betæ*). He has confirmed the previous investigations in that his analyses of the ash of the diseased portions of the roots showed a decided increase in the percentage of ash and a higher amount of iron oxid and alumina. These amounts were found to fluctuate widely in different specimens, and the author believes that the increase is not directly due to the disease, but that the roots are rendered much more spongy by reason of the fungus attack. Consequently the fine particles of the soil adhere to them and are not removed in the ordinary process and scrubbing preliminary to analysis.

A fungus disease of greenhouse lettuce, J. B. DANDENO (*Rpt. Mich. Acad. Sci., 8 (1906), pp. 45–47, figs. 2*).—A brief account is given of a disease of greenhouse lettuce, which is reported as being caused by *Marsonia perforans*. This fungus causes characteristic perforations in the leaves and is frequently very troublesome in lettuce houses. A study by the author has led him to the conclusion that the fungus has been wrongly referred, and he proposes for it the name *Didymaria perforans*, a technical description of which is given.

Some notes on the destruction of plum trees, E. RABATÉ (*Semaine Agr. [Paris], 26 (1907), No. 1339, pp. 429, 430*).—According to the author, there has been known in France for many years a peculiar disease of plum trees which is apparently becoming more frequent. The affected trees are covered with gum, the flowers are aborted, and the tips of the young branches are dead. Later the withered appearance of the branches descends to the trunk.

The disease may occur in isolated trees, from which it spreads either along the rows or radially from the center of infection.

An examination of the dead trees shows that there are two parasites, which are usually associated, although sometimes occurring separately. The first is a mushroom, probably *Armillaria mellea*, which develops on the roots and forms a white felt between the bark and the wood of the tree. It also produces rhizomorphs, by which new plum trees, grapevines, and other fruit or forest trees are attacked.

The insect associated with this disease is one of the fruit tree bark borers (*Scolytus rugulosus*). It is most frequently found on trees where there is a decided diminution in the flow of sap, such as follows an attack of the fungus on the roots.

In order to combat this disease the author recommends the burning of all infested trees, the digging of trenches about 30 in. deep around the trees, and disinfecting the soil with carbon bisulphid. Care should be exercised not to replant plum or other susceptible trees in the infected areas. In combating the bark borer, in addition to the suggestions given, the author recommends vigorous pruning, burning the infested branches and bark, and spraying with various insecticides. It will be found that anything that increases the vigor of the trees, such as the removal of mosses, lichens, and fungi, thinning the fruit, etc., will aid in combating this disease.

An outbreak of the European currant rust, F. C. Stewart (*New York State Sta. Tech. Bul. 2, pp. 61–74, pls. 3*).—During September, 1906, the author observed an unusual appearance of the foliage of currant bushes at the station, and an examination showed that they were infested by the European currant rust (*Cronartium ribicola*).

In the plantation there were about 175 plants, including 54 varieties of different species of Ribes, 48 of which were more or less infested with the rust. In spite of a very severe attack on the black currants, the plants were in full foliage, and the red and white varieties seemed only slightly affected. In another portion of the station grounds a number of currants of different species were growing, but only two plants were found to be attacked.

Cronartium ribicola appears during the summer and autumn as a conspicuous orange-colored powder on the under surface of the leaves of various species of currants and gooseberries. The æcidial form occurs on the trunks and branches of species of pine, particularly the white pine (*Pinus strobus*), where it produces a disease known as blister rust.

The fungus occurs throughout a number of European countries, but has never been reported from Australia or South America, and only once previous to this time from North America. From the information at hand it appears that as a currant disease, *Cronartium ribicola* is regarded as of little importance in those regions where it is abundant, but as a disease of white pine it causes much damage.

The author has undertaken to trace the origin of the outbreak at Geneva, but with little success. It appears that some of the varieties of currants were imported from Europe a few years ago, and that some pines which are near by are also of European origin, so that the fungus possibly was introduced with either the currants or the pines.

In order to stamp out the rust, if possible, every plant of the different species of Ribes on the station grounds has been destroyed. The white pines standing near the currant plantation will be kept under observation to see if the disease appears upon them, in which case they too will be destroyed. It is possible that the rust might be controlled on currants and gooseberries by spraying with

Bordeaux mixture, but one application of that fungicide made as soon as the fruit has set apparently had no effect. A bibliography of the fungus is given.

The appressoria of anthracnoses, H. HASSELBRING (*Bot. Gaz., 42 (1906), No. 2, pp. 135–142, figs. 7*).—A number of observers have reported the presence of peculiar sporelike organs which are produced by the germ tubes of spores of various anthracnoses. By some these are regarded as secondary spores, but it appears that Frank was the first to recognize their true nature, and he gave to the organs of this class the name appressoria, or adhesion organs.

In order to clear up some of the uncertainty regarding these organs the author carried on experiments and observations on the appressoria of the apple bitter rot (*Glœosporium fructigenum*). His experiments show that the formation of appressoria is induced by a contact stimulus, and in the presence of abundant nutrient material the germ tubes lose their power to react to contact stimuli, and the formation of appressoria is inhibited.

The appressoria were found to germinate readily on a slide when covered with nutrient solution, and the process of penetration was studied by sowing spores on berries of *Berberis thunbergii*. From the pore on the lower flattened side of the adhesion disc a slender tube was observed to protrude, which dissolved a narrow channel in the wax covering of the cuticle. Although at first very slender, the hypha soon became larger and dissolved large cavities in the wax. Finally the cell wall was perforated and the mycelium branched freely within the cells. The penetration of the germ tube through the cuticle of the apple has been frequently observed, but contrary to former supposition no previous injury or puncture of the fruit is necessary.

The behavior of the appressoria of the bitter rot fungus under natural conditions is biologically interesting. The spores of this fungus are embedded in a gelatinous substance, which causes them to stick together in waxy masses when dry. By reason of this condition the spores can not be distributed by the wind, but are almost entirely dependent on rain for dissemination. This has been shown in the conelike distribution areas observed on apple trees due to the washing of the spores from the limb cankers to the apples below.

Since rain is the chief factor in distributing the bitter rot spores, the effect of wetting and drying on the vitality of the spores and the appressoria was studied. It was found that the appressoria are much more resistant to the injurious effect of drying than the spores.

In conclusion the author states that the sporelike organs formed by germ tubes of the anthracnoses are adhesion organs, by means of which the fungus is attached to the surface of its host during the early stages of infection. They are not suited for dissemination and are therefore not to be regarded as spores. The adhesion discs are formed as a result of stimuli from mechanical contact acting on the germ tubes, and under natural conditions the appressoria are formed as soon as the germ tube emerges from the spore.

A disease of the Carolina poplar, G. DELACROIX (*Bul. Trimest. Soc. Mycol. France, 22 (1906), No. 4, pp. 239–252, pl. 1*).—A description is given of a disease of poplars due to *Dothichiza populea*, a previous account of which has been noted (E. S. R., 18, p. 551).

"Cluster-cup" disease of conifers, G. MASSEE (*Roy. Bot. Gard. Kew, Bul. Misc. Inform., 1907, No. 1, pp. 1–3, pl. 1*).—A description is given of the cluster-cup on certain species of conifers, the fungus being *Calyptospora gœppertiana*. In the alternation of generations, the fungus occurs also on Vaccinium, but it has been found that where conifers are not present the fungus can reproduce itself entirely on its Vaccinium host.

The cluster-cup stage is reported as occurring on various species of fir, in all 10 species having been observed as host plants, while the resting spore condition

occurs chiefly on *Vaccinium vitis-idæa*, but it has been reported upon other species.

The fungus seems to be rather destructive to young conifers, both in the seed bed and in plantations, and the author recommends care in selecting sites for the seed bed or nursery and the destruction of diseased plants as far as possible.

A sclerotium disease of China asters, F. Guéguen (*Bul. Trimest. Soc. Mycol. France, 22 (1906), No. 4, pp. 254–265, pl. 1, figs. 5*).—A description of a sclerotium disease of China asters in which the fungus attacks the plant at the collar, causing it to be easily decorticated and sooner or later resulting in its destruction. The fungus, which was studied in various media, is designated as *Acrostalagmus vilmorinii* n. sp., a technical description of which is given.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Wolves in relation to stock, game, and the national forest reserves, V. Bailey (*U. S. Dept. Agr., Forest Serv. Bul. 72, pp. 31, pls. 3, figs. 5*).—The purpose of this bulletin is to furnish information to the hunter, trapper, forest ranger, and ranchman regarding trapping, poisoning, and hunting wolves.

The wolves of the United States are commonly divided into 2 groups, including coyotes and gray, or timber, wolves. The gray wolf of the plains is the more destructive to stock. This animal breeds and builds its dens below the edge of forest reserves or in the open foothill country.

Statements are given regarding the present abundance of wolves in the various States where they occur. Wolves cause the greatest destruction to calves and yearlings, but also attack and kill horses, sheep, goats, hogs, and various game animals. The losses due to the attack of wolves upon calves sometimes amount to 10 per cent.

The protective measures which have been adopted include the use of wolf-proof fences, granting bounties, direct destruction by hunting, poisoning, trapping, and killing of the young in dens. The bounty system has not proved very satisfactory and hunting is too expensive of time and labor. Locating the dens and destroying the young is a very effective way of destroying wolves. The size of the litter ranges from 5 to 13. The breeding season appears to be in January and February. In poisoning wolves the best results are obtained from the use of strychnin, of which from 2 to 4 grains are required to kill a 100-pound wolf. The strychnin should be inclosed in a gelatin capsule and inserted in a piece of beef suet. Directions are also given for the use of traps and the preservation of wolf skins, which are worth from \$4 to \$6 for rugs.

Eleventh annual report of the State entomologist of Minnesota, 1906, F. L. Washburn (*Ann. Rpt. State Ent. Minn., 11 (1906), pp. VIII + 88, pls. 7 figs. 59*).—During the year under report especial attention was given to a study of the cabbage maggot, which caused great injury to cabbage, cauliflower, turnip, and radish plants.

The life history of the insect was studied and experiments were carried out to develop successful methods in controlling it. It seems somewhat impracticable to apply remedies after a field becomes infested. Better results are obtained by preventive methods, particularly cultural ones. Some benefit was obtained from immersing the roots of the plants at the time of setting in hellebore and water, and also from the use of glue and sawdust or bran. The natural enemies of this pest furnish some assistance. Further experiments will be made in developing remedies.

A list is given of insects reported as injurious during the year and also a brief statement of the laws prevailing in different States concerning nursery

inspection. The author also discusses orchard spraying and presents a short entomological calendar. Notes are given on the life history and means of combating a number of injurious insects, including cottony maple scale, soft plum scale, army worm, cutworms, stalk borer, household insects, and white grubs.

Some insects of orchard and other fruits, C. F. Adams (*Arkansas Sta. Bul. 92, pp. 17, figs. 21*).—Brief biological and economic notes are given on codling moth, San José scale, apple-twig borer, flat-headed apple borer, buffalo tree hopper, twig girdler, woolly aphis, pear-tree slug, plum gouger, plum curculio, peach borer, peach twig borer, blackberry crown borer, strawberry weevil, etc.

Report of the division of entomology, R. C. L. Perkins (*Hawaiian Sugar Planters' Sta. Rpt. 1906, pp. 43–50*).—A brief statement is made regarding the work of the traveling entomologists, the distribution of beneficial insects in Hawaii, the inspection of plantations, and miscellaneous entomological work.

Problems in economic entomology in the Philippines, C. S. Banks (*Philippine Jour. Sci., 1 (1906), No. 10, pp. 1067–1074*).—Attention is called to some of the economic problems which have arisen in the study of insects in the Philippines. It is believed that special attention must be given to locusts, rice insects, white ants, insects affecting domestic animals, pests of sugar cane, sorghum, tobacco, and forests, and to the study of silkworms and bees.

Entomological notes, J. M. Hayman (*Rpt. Cawnpore [India] Agr. Sta., 1906, pp. 32, 33*).—A pod borer is reported as causing considerable damage every year to chick-peas. The larvæ appear first on the leaves and might be controlled by arsenical sprays applied at that time. Brief notes are also given on a species of Cecidomyia found on wheat.

Biological division, C. M. G. Johnston (*Orange River Colony Dept. Agr., Ann. Rpt., 2 (1905–6), pp. 243–259, figs. 10*).—Attention has been given to the destruction of locusts by spraying and the use of poisoned baits as well as by other methods. Mention is made of the insect parasites of the migratory locust.

Notes are also given on insects injurious to stock and orchard, garden, and field crops, including ticks, bollworm, cutworms, and potato tuber moth. A brief description is included of certain plants which are supposed to be poisonous to stock.

The pests of sugar beets in Bohemia in 1905, H. Uzel (*Ztschr. Zuckerindus. Böhmen, 31 (1907), No. 4, pp. 217–225, fig. 1*).—A list is given of a considerable number of insects which attack sugar beets, and brief mention is made of the injury to sugar beets by nematodes and parasitic fungi.

The boll weevil, C. W. Flynn, Jr. (*Crop Pest Com. La. Circ. 11, pp. 19, figs. 2*).—In cooperation with the Bureau of Entomology of this Department a number of cultural experiments were carried out in different sections of the cotton belt, during which it appeared that Triumph cotton is the best variety for use in sections infested with the boll weevil. Northern-grown seed, in order to retain its early maturing qualities, must be renewed from its northern sources at least every other year. The results obtained from these experiments confirm previous work along this line, and the author therefore recommends thorough preparation of the soil, early planting, the use of early varieties of cotton, abundant fertilizers, thorough cultivation of the crop, and the destruction of cotton plants in the fall.

Hibernation and development of the cotton-boll weevil, E. D. Sanderson (*U. S. Dept. Agr., Bur. Ent. Bul. 63, pt. 1, pp. 1–38, figs. 6*).—Since many cotton-boll weevils die during hibernation, it was thought wise to study the effects of various conditions during hibernation upon the mortality of the weevil. It appears that the weevils can not be forced into hibernation until the mean average temperature drops below 60° F. If, therefore, the weevils are deprived

of food during the fall, the percentage of mortality among them may be greatly increased.

The cotton worm is considered of some benefit in this regard, since its chief attack is made upon the cotton plant late in the season, thus destroying the leaves and other edible parts upon which the weevils might otherwise feed. The same result may be brought about by cattle grazing.

The mortality of cotton-boll weevils during hibernation is so great in some instances that not more than 2½ to 15 per cent survive. The maximum rate of mortality in weevils occurs in December or January and is increased by large rainfalls.

The emergence of the maximum number of weevils takes place in Texas from May 20 to June 1. Notes are given on various other points in the biology of the cotton-boll weevil, including summer broods, rate of increase, injury to cotton squares, etc.

Notes on the biology of certain weevils related to the cotton-boll weevil, W. D. PIERCE (*U. S. Dept. Agr., Bur. Ent. Bul. 63, pt. 2, pp. 39–44, pl. 1*).—It is assumed that parasites useful in controlling the cotton-boll weevil may be found by studying its nearest relatives. On this account biological and economic notes are given on *Anthonomus disjunctus*, *A. fulvus*, *A. squamosus*, *Lixus musculus*, *Orthoris crotchii*, etc.

An ant enemy of the cotton-boll weevil, W. E. HINDS (*U. S. Dept. Agr., Bur. Ent. Bul. 63, pt. 3, pp. 45–48, fig. 1*).—Among the native species of ants which prey upon the cotton-boll weevil, *Solenopsis geminata xyloni* is considered to be the most important. This ant is described and notes are given upon its predaceous habits. It eats holes into infested squares and destroys the cotton-boll weevil in such squares in whatever stage they may be found. Among 137 squares entered by ants not a single weevil escaped destruction. The ants nest in the cotton field and appear to be widely distributed through the cotton belt including Texas and western Louisiana.

A predatory bug reported as an enemy of the cotton-boll weevil, A. C. MORGAN (*U. S. Dept. Agr., Bur. Ent. Bul. 63, pt. 4, pp. 49–54, figs. 2*).—A report was received that *Apiomerus spissipes* was attacking the cotton-boll weevil. A study was made of this bug, giving attention to its life history, food habits, distribution, and natural enemies.

The results were unfavorable to the supposition that the bug is of value in controlling the cotton-boll weevil. It is comparatively rare in cotton fields especially during the time when the weevils are most numerous and the young bugs show a high rate of mortality.

The brown-tail moth and the gypsy moth in New Hampshire in 1906, E. D. SANDERSON and L. O. HOWARD (*New Hampshire Sta. Bul. 128, pp. 211–230, figs. 8*).—A statement is made of the spread and present distribution of the brown-tail moth and of the work which has been done by various towns in combating it. During the season of 1905–6 about $6,000 was spent by the towns in New Hampshire in this work. The best results are obtained from the destruction of winter webs, but spraying is effective if done in early May.

The State has not taken up the control of the gypsy moth and work thus far done against this insect has been under the supervision of this Department. The present status of the gypsy moth in New Hampshire is outlined. It is estimated that the preliminary work of inspection will cost about $150 per town; putting on burlaps and attending them for 2 months, $1,000 per town; and the total cost of thorough work of control about $2,000 per town.

The oyster-shell scale, T. B. SYMONS (*Maryland Sta. Bul. 111, pp. 57–70, figs. 8*).—During the past 2 years the oyster-shell scale has attacked and destroyed a large number of mature maple trees. The insect is found chiefly

on the young branches and does not cause the death of the trees except after an infestation of considerable duration. Brief notes are given on the life history and food plants of this pest. The author tried, apparently for the first time, lime-sulphur-salt as a remedy for oyster-shell scale on maples. The trees were sprayed in November and April, and it was found that the insect could be controlled with satisfactory results and without injury to the trees.

If only one application is possible the fall appears to be the better time. A thorough application in the spring, however, may sometimes be even more effective. Lime-sulphur-salt should be used only during the dormant season. Kerosene emulsion gives excellent results if applied in May when the young scales are just beginning to crawl about.

Combating the oyster-shell bark-louse and other entomological problems, DUKE OF BEDFORD and S. U. PICKERING (*Woburn Expt. Fruit Farm Rpt., 6 (1906), pp. V + 235*).—On account of the extensive injury caused to fruit growers by the oyster-shell bark-louse, the authors organized an elaborate and thorough campaign for determining the most effective and practical remedies against this pest.

Winter applications of insecticides were made for the purpose of destroying eggs and removing moss and lichens from the bark. The alkali wash generally recommended for winter use is a 2 per cent solution of caustic soda and carbonate of potash. The experiments carried on by the authors, however, indicate that carbonate of potash has very little effect and that the value of the mixture is lessened by substituting any of it for a 2 per cent solution of caustic soda. The best results were obtained by a mixture containing 2 per cent caustic soda and 2 or 3 per cent of soap. The soda-soap wash destroys from 70 to 90 per cent of the eggs.

Less satisfactory results followed the use of kerosene emulsions, since when enough kerosene was added to be effective the trees were injured, and a sufficient quantity of soap appeared to be too expensive. Further experiments along this line, however, showed that a weak kerosene emulsion containing 2 per cent of caustic soda would destroy all of the eggs. This mixture contains 6 per cent of kerosene and 0.5 per cent of soap, the preparation being made of 1½ lbs. of soft soap, 2 gal. of kerosene, and 6 lbs. of caustic soda per 30 gal. of water.

The authors do not recommend the use of undiluted kerosene for spraying purposes. Fumigation with hydrocyanic-acid gas in ordinary proportions also had no effect on the eggs of the scale. For summer treatment the use of a weak kerosene emulsion containing 1.25 per cent of kerosene and 2.5 per cent of soap is recommended.

A summary is presented of the work which has thus far been done in this country and elsewhere on the San José scale. In destroying moss good results followed the use of a 2 per cent solution of caustic soda. The authors also obtained satisfactory results from the use of lead arsenate as an insecticide for leaf-eating caterpillars.

Treating San José scale, T. B. SYMONS and A. B. GAHAN (*Maryland Sta. Bul. 112, pp. 71–88, figs. 7*).—The aggressive orchardists of Maryland are able to control the San José scale, but in a number of localities this pest affords serious difficulties. Wherever osage orange hedges become infested the difficulty of eradicating the San José scale is increased.

A number of experiments were tried with different insecticides in combating the pest. Lime and sulphur mixtures were used containing from 20 to 30 lbs. of lime and from 15 to 25 lbs. of sulphur per 50 gal. of water. The lime-sulphur-salt mixture, tested by the authors, was made according to the formula 20–15–10–50.

Lime-sulphur-caustic soda preparations were also employed, as well as a mixture containing 15 lbs. sulphur and 10 lbs. of caustic soda per 50 gal. of water.

In most cases the weaker lime-sulphur preparations were about as effective as the stronger, but in a few instances an increased effectiveness was noticed where 35 lbs. of lime and 30 lbs. of sulphur were used per 50 gal. of water. Perfectly satisfactory results were obtained from the use of lime-sulphur-salt, and lime-sulphur-caustic soda also proved fairly effective. The sulphur-caustic soda mixture was not so satisfactory. Kerosene limoid did not prove to be a good substitute for lime-sulphur. Certain proprietary remedies were tested and notes were given on the preparation of the various insecticides which were used.

The black currant gall mite, W. E. COLLINGE (*Jour. Bd. Agr.* [*London*], *13* (*1907*), *No. 10, pp. 585–596*).—The life history of this pest is described and a brief account is given of previous work which has been done in attempts to combat it. In the author's opinion no varieties of the currant are absolutely immune to its attacks.

Fumigation with hydrocyanic-acid gas is not very satisfactory and is too troublesome in large plantations. The author tested a considerable number of insecticides and comes to the conclusion that the application of lime and sulphur will keep the mite in check and, if the spray is applied repeatedly, will perhaps eradicate the pest.

The grape berry worm, H. A. GOSSARD and J. S. HOUSER (*Ohio Sta. Circ. 63, pp. 16, figs. 12*).—During the past 2 or 3 years the grape berry worm has been an unusually serious pest in Ohio, and along the shore of Lake Erie has caused the loss of about one-third of the grape crop. The eggs are minute translucent bodies found on the skins of the grapes in the summer, and the point of entrance of the larvæ into the grape is surrounded by a patch of reddened skin.

In order that the most effective remedies should be directed against the first brood, operations should begin during the fall, consisting of clean cultivation, the destruction of all trash about the vineyard, and thorough plowing. The authors are somewhat in doubt whether fall or spring plowing is best, but it is found that as good results can be obtained by plowing as by burning. The most important measure of all is believed to be spraying with arsenate of lead or Paris green. The arsenate of lead should be used at the rate of 3 lbs. to 50 gal. of Bordeaux mixture. It is recommended that the first application be made in early June, the second as soon as the grapes are through blooming, and the third early in July. The cost of spraying an acre of grapes ranges from $3.75 to $5.

Combating insects and other enemies of agriculture, F. LAFONT (*La Lutte contre les Insectes et Autres Ennemis de l'Agriculture. Paris: Masson & Co.* [*1906*], *pp. 174*).—The usual remedies adopted in controlling insects are outlined with formulas for a large number of insecticides and methods of applying them. The subject-matter concerning specific injurious insects is arranged according to the plants upon which the insects depredate and includes insects which have a wide range of food plants, and enemies of cereals, forage plants, garden vegetables, small fruits, and orchards.

The method for destroying larvæ in tree plantations, EBERHARDT (*Compt. Rend. Acad. Sci.* [*Paris*], *144* (*1907*), *No. 2, pp. 95–98*).—Difficulties are everywhere experienced in combating the larvæ of beetles and other insects which bore in the twigs and trunks of trees. Such larvæ cause enormous losses in Indo-China, especially in plantations of tea, mulberries, and oranges.

In fighting these pests the author recommends that the larvæ be removed by means of a knife and that the wounds be subsequently treated with an anti-

septic wash. For wounds in growing twigs the author recommends a solution containing 4 parts glycerin and 11 parts formalin in 85 parts of water. For wounds in trunks of trees a formula is suggested calling for 6 parts of glycerin and 18 parts of formalin in 76 parts of water.

Third report on dust and liquid spraying, C. P. CLOSE (*Delaware Sta. Bul. 76, pp. 19*).—The work reported in this bulletin largely confirms previous results obtained by the station (E. S. R., 17, p. 994). A comparison was made between dusting with Paris green and full strength or half strength Bordeaux with Paris green and also between Paris green and arsenate of lead with Bordeaux mixture. The kerosene-lime-Bordeaux poison mixture was also tested. Applications of these insecticides were made on apple orchards, including several varieties. It was found that the total cost of spraying with dust was 2 cts. per tree, as compared with 4.75 cts. with the liquid application.

Details of results are presented in a tabular form. The comparison of full strength and half strength Bordeaux mixture showed that the half strength kept the fruit and foliage apparently as healthy as was the case when full strength Bordeaux mixture was used. The apples showed no russeting, but the amount of dropped fruit was somewhat less when the full strength mixture was applied. The liquid spray controlled bitter rot better than dust spray, but apple scab was entirely controlled by either method.

A preliminary account of the life history of the common house fly, C. G. HEWITT (*Mem. and Proc. Manchester Lit. and Phil. Soc., 51 (1906–7), pt. 1, No. 1, pp. 1–4*).—According to the author's observations each female house fly deposits about 120 eggs in fresh horse manure. In hot weather it was found that the whole life cycle might be passed through in 15 days.

Apiculture, T. W. KIRK (*New Zeal. Dept. Agr. Ann. Rpt., 14 (1906), pp. 427–434, pls. 6, figs. 3*).—The subject of poisonous honey was investigated. In samples of honey said to have been poisonous to native Maoris, pollen grains were found apparently belonging to *Ranunculus rivularis* or some related species and other honey-producing plants, particularly *Knightia excelsa.* The evidence obtained in this study was not conclusive, but indicates that the pollen grains of some of the plants may exercise a poisonous effect.

Notes are also given on the inspection of apiaries, the organization of a state apiary, foul brood, and the introduction of bees into New Zealand.

Bees, A. LUDWIG (*Unsere Bienen. Berlin: F. Pfenningstorff [1907], pp. VIII + 831, pls. 54, figs. 369*).—The present volume constitutes an elaborate handbook covering all the points on which the bee raiser desires information. Special chapters are devoted to the biology and life history of bees, economic importance of apiculture, various methods of managing bees, bee apparatus and appliances, the utilization of honey, the history and present status of the varieties of bees, the diseases of bees, and other related matters.

Breeding bees by selection, F. W. L. SLADEN (*Brit. Bee Jour., 35 (1907), No. 1282, pp. 21–23*).—In the author's first efforts to improve the honey-producing character of bees, little difficulty was experienced in making selection of the best honey-producing colonies on the queen side, but on the drone side the selection was much more difficult. At first it was almost impossible to identify the offspring of particular queens and drones. Finally differences in color were hit upon as furnishing a means for such selection.

It was soon found that there was little or no correlation between the color character and the honey-producing character. These two characters appeared to be inherited independently. There were dark and light colored bees of high and low honey-producing power. All the light-colored bees except the best honey producers were eliminated from the breeding experiments, and light-colored drones of good parentage were crossed on queens obtained in this way.

The color effects thus produced in breeding could be distinguished as soon as the first few hundred workers were hatched or within a month after the queen was fertilized. A bright-colored race of bees has been produced by this system of selection from crossing the black native bees and the American Golden Italian bee. The name British Golden bee has been given to the new race and a considerable improvement in honey production has been noted.

After the characters have been fixed in some of the offspring obtained from crossbreeding, it has been found that "the workers of the colony that produced the drones' mother show fairly accurately the characters that the drones are likely to transmit."

Sericulture in Indo-China, P. VIEIL (*Bul. Écon. Indo-Chine, n. ser., 9 (1906), No. 57, pp. 939–973, figs. 15*).—A general account is given of the culture of mulberries in Indo-China for feeding to silkworms and of the varieties of the mulberries planted for this purpose. The commonest race of silkworms in Indo-China is one with several generations a year and with golden cocoons. A description is also given of the diseases of silkworms and of various technical operations in connection with this industry.

Silkworms of Madagascar, GRANGEON (*Agr. Prat. Pays Chauds, 6 (1906), Nos. 44, pp. 362–369; 45, pp. 495–502, figs. 14*).—Notes are given on the races of silkworms observed in Madagascar and on the insect, fungus, and bacterial diseases which attack them.

On the polygamous habit of the silkworm, K. TOYAMA (*Bul. Assoc. Seri. Japon, 1907, No. 176, pp. 1–15*).—The belief prevails among many silk raisers in Japan that silkworms should be kept in monogamous condition in order to secure the greatest health of offspring. An experimental study of this, however, showed that there is no appreciable difference in the vigor of offspring whether the male moths are mated with one or six or more females. Further studies along this line are contemplated.

FOODS—HUMAN NUTRITION.

Instructions concerning trade labels under the meat-inspection law and regulations, A. D. MELVIN (*U. S. Dept. Agr., Bur. Anim. Indus., pp. 6*).—In this circular, issued Dec. 10, 1906, the instructions given are intended, so far as possible, to cover the interpretation of the meat-inspection law regarding trade labels and to give the tentative rulings made by the Pure Food Commission under the national pure-food law.

"The essential features of a label must be placed together in any desired order without interspersing any descriptive, qualifying, or advertising matter. The essential features are as follows:

"The true name of the product.

"The true name of the manufacturer, if given.

"The true name of the place of manufacture, if given.

"The name of the manufacturer is not required under the meat-inspection or pure-food laws, but if given it must be the true name.

"Persons, firms, or corporations owning subsidiary companies having legal entity may use the names of such companies, provided application has been made for inspection, and it has been granted; the inspection legend in such case to bear the establishment number of the parent firm or corporation."

Examples are given showing the application, of the feature outlined, to labels for ham, sausage, lard, lard compounds, substitutes, etc.

Food inspection, C. D. WOODS and J. M. BARTLETT (*Maine Sta. Bul. 135, pp. 229–250*).—This bulletin contains the text of the State pure-food law enacted in

1905 and the revised standards of purity of food products which have been adopted for Maine.

Food inspection, C. D. WOODS and J. M. BARTLETT (*Maine Sta. Bul. 136, pp. 251–282*).—Under the State pure-food law a number of samples of baking powders, spices, and vinegars were examined.

With the exception of 2 samples of old goods, the baking powders were correctly labeled. All the samples of allspice, cassia and cinnamon, ginger, cloves, and Cayenne or red pepper were genuine, though some samples of ginger were weak and may have contained exhausted ginger and some of the samples of cloves carried undue amounts of cloves' stems, and others may have contained exhausted material. Several samples of mustard and black pepper were adulterated. The vinegars on sale were in general more satisfactory than a year ago, "still the analyses show that vinegars were on sale in the State that were not correctly branded."

Food analyses: Report of chemist, J. T. WILLARD (*Bul. Kans. Bd. Health, 2 (1906), No. 6, pp. 150–161*).—A large number of samples of canned goods, pickles, flavoring extracts, condiments, dairy products, flour, and meat were examined and a method described for the detection of bleaching in flour.

Small quantities of flour are shaken with a few cubic centimeters of water and the mixture tested for nitrites. "One-half gram of sulfanilic acid is dissolved by heat in 150 cc. of dilute acetic acid. One-tenth gram of α-napthylamin in heated with 20 cc. of strong acetic acid and the colorless solution poured off from the residue and mixed with 130 cc. of dilute acetic acid. For use, the 2 solutions are mixed in equal quantities and 2 cc. of the mixed solution added to the liquid to be tested."

Investigations on the properties of wheat proteids, J. S. CHAMBERLAIN (*Jour. Amer. Chem. Soc., 28 (1906), No. 11, pp. 1657–1667*).—The author's conclusions were in effect as follows: Dry gluten contains about 75 per cent proteids and 25 per cent nonproteid bodies. Of the total proteids present in wheat 60 to 65 per cent are present in the gluten and 35 to 40 per cent are lost in the washings.

The balance between the nonprotein present in the gluten and the loss of protein in washing makes gluten determinations agree roughly with total protein calculated from total nitrogen, but they will usually run below with whole wheat and above with flours.

The amount of total protein present in gluten is about 15 per cent less than the sum of the gliadin and glutenin determined by extraction of the wheat, and the loss of protein in washing out gluten is more than equal to the salt solution soluble protein. Therefore the loss of protein in the determination of gluten is at the expense of gliadin or glutenin, the true gluten protein of wheat.

On account of these losses and errors the author believes that the determination of gluten yields no information which can not be gained either from the determination of total protein or the determination of the alcohol soluble and insoluble proteids.

The constitution of Java cane-sugar molasses, H. C. P. GEERLIGS (*Internat. Sugar Jour., 8 (1906), Nos. 85, pp. 26–35; 86, pp. 86–95; 87, pp. 156–164*).—Some of the conclusions follow which were drawn from an extended study of Java sugar cane and molasses:

"The constitution of the molasses is chiefly governed by the constitution of the sirup, and this again is dependent on the constitution of the raw cane juice and on the method of clarification.

"The percentage of inorganic elements in the raw juice, together with its glucose content, is one of the chief factors for the limit below which the molas-

ses can not be further desaccharified; in so far that a high quotient between glucose and ash coincides with a low quotient of purity, and vice versa.

"The amount of inorganic constituents, principally potash salts, in the juice is a consequence of the conditions of the soil, the climate, and the labor, and is to a certain extent constant for the cane from any given area.

"Generally, a low quotient of purity of the juice of ripe cane accords with a high content of inorganic bodies, chiefly potash salts. . . .

"Carbonatation removes gums, phosphates, and silica much more thoroughly than defecation."

The value of cocoa as a food and condiment. Experiments with man, R. O. NEUMANN (*Arch. Hyg., 58 (1906), No. 1, pp. 1–124, pls. 3, figs. 8; München. Med. Wchnschr., 53 (1906), No. 10, pp. 481, 482*).—A large number of experiments with cocoa of different sorts were made in which the effect of the quantity eaten, the fat content, the amount of shell present, and other questions were studied. Among the conclusions drawn were the following:

The way in which cocoa is consumed, whether alone or with other foods, has a marked effect on its absorption. The minimum digestibility of protein, 45 per cent, was noted when cocoa was eaten alone. The presence of cocoa diminished the digestibility of nitrogenous constituents of the diet as a whole, the amount being proportional to the quantity of cocoa taken. This lowering of protein digestibility is due to the fact that cocoa increases markedly the amount of feces. This increase is accompanied by a corresponding decrease in the amount of nitrogen in the urine. The lower the fat content of the cocoa the greater the depression of the coefficient of digestibility of protein. A large proportion of shell in cocoa also has an unfavorable effect on the excretion of nitrogen. Cocoa protein may replace a part of the protein of the diet. The digestibilty of cocoa fat varies considerably, the separated cocoa butter being 94.7 per cent digestible, as compared with 94.9 per cent in the case of the fat of a normal diet. When fat is taken as a part of the cocoa its coefficient of digestibility is somewhat lower. Cocoas rich in fat improve the digestibility of the fat of the entire diet. When large quantities of cocoa are taken the theobromin present produces transitory disturbances, but the amount present in small quantities of cocoa, such as the 20 or 30 gm. ordinarily taken per day, produces a pleasantly stimulating effect. No diuretic effect was noted.

In general, the experiments showed that cocoa was a satisfactory food material and, in the author's opinion, cocoa with a high fat content is to be preferred to one from which the fat has been very largely removed. He therefore suggests a fat content of 30 per cent as the minimum requirement.

Chemical composition of chestnut flour, and study of two sugars contained therein, R. PALADINO (*Rend. Accad. Sci. Fis. Mat. Napoli, 3. ser., 12 (1906), pp. 117–123; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 527, pp. 624, 625*).—One of the sugars identified gave crystals resembling those of sucrose and gave an osazone melting at 204° C. It had a specific rotation corresponding to that of sucrose. The aqueous extract yielded a reducing dextrorotatory sugar which gave an osazone melting at 204°.

The presence of formalin in foods, G. PERRIER (*Compt. Rend. Acad. Sci. [Paris], 143 (1906), No. 17, pp. 600–603*).—The possible occurrence of formalin in smoked food products is pointed out and determinations reported of the amount present in a number of products; for instance, 0.03 to 1.20 mg. was found per 100 gm. in ham and 0.04 to 0.6 mg. per 100 gm. in smoked sausage. The necessity of taking into account in pure-food legislation the occurrence of formalin under such circumstances is pointed out.

The volume and specific weight of the human body, J. WENGLER (*Arch. Physiol.* [*Pflüger*], *115* (*1906*), *No. 11–12, pp. 612–621, fig. 1*).—Using specially constructed apparatus the author measured the volume and specific gravity of the human body as it is ordinarily considered and with the exclusion of the included air which is variable in quantity. According to his results the body volume of the person experimented upon, exclusive of the air contained in the body, was 71.76 liters, and the specific gravity of the body substance, air excluded, was 1.05.

On the influence of neutral salts upon the rate of salivary digestion, JANE B. PATTEN and P. G. STILES (*Amer. Jour. Physiol., 17* (*1906*), *No. 1, pp. 26–31*).—As shown by the experimental data, ptyalin is very active in the presence of many salts in high concentration, the effect being observed even in the case of some saturated solutions, notably those of magnesium sulphate and ammonium chlorid.

"The most striking instances of accelerating effects were obtained with salts of magnesium, calcium, and barium—belonging to a natural chemical group. But with increasing concentration these salts diverge in their behavior, and calcium chlorid at last restrains the enzym, which never becomes true of magnesium sulphate.

"When we compare the retarding influence of salts of ammonium, potassium, and sodium we find the ammonium compound much less active in checking the digestion than either of the other two. There seems to be no marked difference between the sodium and the potassium salts. Sodium chlorid retards somewhat more than does potassium chlorid, and this order holds for the sulphates, but seems to be reversed for the benzoates."

Other questions were also considered.

Investigations in physical chemistry and their relation to digestion and resorption, E. REISS (*Zentbl. Gesam. Physiol. u. Path. Stoffwechsels, n. ser., 1* (*1906*), *Nos. 12, pp. 353–360; 13, pp. 404–415, fig. 1; 14, pp. 438–447*).—Recent advances in physical chemistry are summarized and discussed with special reference to the physiology of secretion, resorption, and digestion, and also the pathology of the subject.

The chemistry and biochemistry of creatin and creatinin, O. FOLIN (*Upsala Läkareför. Förhandl., n. ser., 11* (*1906*), *Sup. III, pp. 20*).—Having shown by laboratory experiments that creatin can not be readily converted into creatinin, the author carried on experiments to determine whether the commonly accepted view is tenable that creatin is a waste product of protein metabolism, which is eliminated in the urine in the form of its anhydrid creatinin.

The conversion of creatin of the food into creatinin was not observed in the body. Neither creatin taken in the food nor the nitrogen equivalent to it was found in the urine when it was taken in a diet low in protein. It was, however, apparently utilized in the body, as none was found in the feces. When taken with a diet rich in protein creatin itself rather than its decomposition products appeared in the urine.

As a working hypothesis for subsequent experiments, the author suggests the theory that creatin as distinguished from creatinin is a food and not a waste product. Its behavior is clearly unlike that of an ordinary amino-acid, the nitrogen of which would appear as urea.

"It is possible that the nitrogenous substances which serve to maintain the nitrogen equilibrium in the living tissues are special products which do not easily take part in the urea-forming processes. Creatin may be one such product, is therefore retained in the general tissues, and consequently we find the muscles rich in creatin. When the organism is daily supplied with an abundance of protein it may then be preparing as much creatin as is needed

for the maintenance of its normal supply. The creatin given with the food is consequently not absorbed and retained by the muscles to the same extent as when the food contains an insufficient supply of protein."

Experiments on the origin of creatin in the animal body, M. Jaffé (*Ztschr. Physiol. Chem., 48 (1906), No. 5, pp. 430–468*).—Glycocyamin (guanidin acetic acid) forms creatin in the body by the addition of a methyl radical. Arginin is probably not an intermediate product. The experiments were made with rabbits.

The excretion of creatin and creatinin by man, K. O. af Klercker (*Beitr. Chem. Physiol. u. Path., 8 (1906), No. 1–2, pp. 59–61*).—According to the author's experiments the consumption of protein had practically no influence upon creatinin excretion.

In general the author is of the opinion that although most of the creatin and creatinin supplied by the food is excreted through the kidneys, a little is utilized by the body, creatin being the more readily utilized of the two. His experiments furnish no evidence that any exogenous creatin is converted into creatinin.

The elimination of creatinin, O. E. Closson (*Amer. Jour. Physiol., 16 (1906), No. 2, pp. 252–267, fig. 1*).—The data reported indicate that creatinin is a constituent of the urine from an early period in man, dogs, and cats, and, independent of the ingestion of creatin and creatinin, forms a characteristic endogenous catabolic end product of metabolism.

Experiments on the physiological action and metabolism of anhydro-oxymethylene-diphosphoric acid (phytin acid), L. B. Mendel and F. P. Underhill (*Amer. Jour. Physiol., 17 (1906), No. 1, pp. 75–88*).—According to the authors, a solution of anhydro-oxymethylene-diphosphoric acid, the acid radical of phytin, prepared from wheat bran, appears to be quite stable. When present in sufficient concentration it hinders growth of bacteria, but the salts of the acid are not noticeably bactericidal.

As shown by the experiments reported, "comparatively large doses of the phospho-organic acid, used as the sodium salt, can be introduced into animals either per os, subcutaneously, intraperitoneally, or intravenously, without unfavorable effects. The free acid is more toxic.

"No marked or immediate characteristic effects of the sodium salt upon general health or nitrogenous metabolism have been observed. The compound is readily absorbed and speedily transformed within the organism. Its phosphorus reappears in the excreta as inorganic phosphates. No constant relation between the metabolism of nitrogen and of phosphorus was observed. In these details our experience with the dog corresponds with the observations of Jordan, Hart, and Patten after feeding phytin to cattle. [E. S. R., 18, p. 568.] Our results differ in showing that in both the dog and rabbit the excess of phosphorus was almost entirely eliminated through the kidneys rather than in the feces. This may have an important bearing on the possibility of producing laxative effects with phytin.

"In our experimental animals purgative action could not be constantly provoked. Very large doses were frequently effective. No permanent generalizations can be drawn from the observations made on this point."

The effect of different factors upon the digestion of protein, P. Salecker and A. Stutzer (*Jour. Landw., 54 (1906), No. 3, pp. 273–282*).—A lowering of the digestibility of protein is noticed in many cases when nitrogenous materials heated for a considerable time at a temperature under that of boiling water are treated with pepsin hydrochloric acid. Apparently the lower digestibility is not due to the action of atmospheric oxygen, but to some molecular change in the proteid molecule. Peat lowers the digestibility of protein, so this material

is not a desirable one to use with molasses in the manufacture of feeding stuffs. When formaldehyde is used as a preservative for substances containing nitrogen the protein is rendered insoluble but, according to the authors, is not indigestible.

The cleavage of protein in the intestine, O. COHNHEIM (*Ztschr. Physiol. Chem., 49 (1906), No. 1, pp. 64–71*).—Through the combined action of pepsin and erepsin very thorough and probably complete cleavage of protein is induced, according to the author's experiments. The reaction is comparatively rapid, being a question of minutes or hours and not of days.

Concerning proteid synthesis in the animal body, H. LÜTHJE (*Arch. Physiol. [Pflüger], 113 (1906), No. 11–12, pp. 547–604*).—Since rabbits often live on roots and potatoes, which contain at least 50 per cent of their nitrogen in nonproteid forms, feeding experiments were made to learn the value of the different nitrogenous constituents. When the nonproteid nitrogenous material of potatoes was fed the rabbits died. In other words, this material did not prevent proteid starvation.

The importance of individual amino acids in metabolism, EDITH G. WILLCOCK and F. G. HOPKINS (*Jour. Physiol., 35 (1906), No. 1–2, pp. 88–102, dgm. 1*).—Zein, obtained by extracting corn meal with 75 per cent alcohol, the authors conclude from their experiments with mice "has no power whatever of maintaining growth in the young animal; loss of weight begins the moment it forms the sole nitrogenous supply. The addition of the missing tryptophan group to the zein has, it is also clear, no power to convert such loss into equilibrium or gain; a fact possibly due to other deficiencies in the zein molecule, such as the absence of lysin, or the lack of some other amino acid not yet observed. There was no close relationship in our experiments between the loss of weight and the length of survival period."

Can nitrogen equilibrium be produced in the animal body by heteroalbumoses? V. HENRIQUES and C. HANSEN (*Ztschr. Physiol. Chem., 48 (1906), No. 5, pp. 383–386*).—The experimental data led to the conclusion that heteroalbumoses and also disalbumose serve as protectors of protein.

Experimental researches on the expiration of free nitrogen from the body, A. KROGH (*Skand. Arch. Physiol., 18 (1906), No. 5–6, pp. 364–420, pl. 1, figs. 8*).—Using a Regnault closed-circuit respiration apparatus of special construction, which is described, experiments were made with chrysalides, eggs, and mice with a view to determining the possibilities of the excretion of free nitrogen. The experiments ranged in length from a few hours to nearly 3 days.

Experiments similar to the early series reported by Regnault and Reiset[a] were also made with small animals confined under bell jars.

According to the author, his investigations as a whole show only "an extremely slight production of gaseous nitrogen, amounting in the case of eggs to 1.5 cc. during the whole period of incubation and in that of mice to 0.01 per cent of the absorbed volume of oxygen. The productions found may be accounted for, as being due to excretion of ammonia or, in the case of eggs, as the setting free of physically dissolved nitrogen. The albumin metabolism does not give rise to any excretion of free gaseous nitrogen from the body."

The sources of error in the work of earlier investigators, who reported a considerable excretion of free nitrogen are pointed out.

The physiological effect of organic bases derived from beef, F. KUTSCHER and A. LOHMANN (*Arch. Physiol. [Pflüger], 114 (1906), No. 11–12, pp. 553–568, pls. 4, dgms. 7*).—Using small animals the physiological effects of oblitin, novain, ignotin, and neosin were studied.

So far as the experiments showed, ignotin had no physiological effect.

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[a] Ann. Chim. et Phys., 3. ser., 26 (1856), p. 310.

Marked effects were noted, however, with oblitin and novain and these bodies were apparently similar in their properties. Neosin also produced physiological effects, but, owing to a lack of material, it was not possible to determine whether or not this body was related to oblitin and novain.

The extractives of muscles. IV, The occurrence of carnosin, carnitin, and methylguanidin in meat, R. KRIMBERG (*Ztschr. Physiol. Chem., 48 (1906), No. 5, pp. 412–418*).—From the experimental data the author concludes that the carnosin, carnitin, and methylguanidin found in meat extract exist in the living muscular tissue.

Muscle extractives. V, The constitution of carnitin, R. KRIMBERG (*Ztschr. Physiol. Chem., 49 (1906), No. 1, pp. 89–95*).—A progress report of the study of the chemical constitution of carnitin. From data at present available it appears that carnitin is a derivative of trimethylamin or contains a trimethylamin group.

Intestinal gases of man, J. A. FRIES (*Amer. Jour. Physiol., 16 (1906), No. 4, pp. 468–474*).—On an average the samples of intestinal gas analyzed contained by volume 10.3 per cent carbon dioxid, 0.7 per cent oxygen, 29.6 per cent methan, and 59.4 per cent free nitrogen. The author believes that the large amount of free nitrogen is not a decomposition product, but rather atmospheric nitrogen swallowed as air with the liquid and solid foods and with the saliva, the oxygen of the air having been absorbed into the blood or having been utilized in some way by the living body.

As to the value of these indifferent gases, carbon dioxid, marsh gas, and oxygen, in man and animals little is definitely known. "We can but conjecture and ascribe to . . . [such a mixture] a rôle of usefulness in the scheme of digestion and assimilation of the food, in that this gas mixture may serve as a regulating agency to regulate the growth of micro-organisms in the digestive tract, checking the growth of some, preventing the growth of others which may find their way into the intestines."

ANIMAL PRODUCTION.

Feeding stuffs, P. DECHAMBRE (*Les Aliments du Bétail. Paris: Asselin & Houzeau, 1906, pp. XV+578*).—A handbook of information regarding materials of importance in feeding farm animals. Composition, digestibility, nutritive ratio, intensive feeding, and related questions are discussed, and the cereal grains and different feeding stuffs, including commercial by-products, are considered in detail.

Concerning the rôle of asparagin in nitrogen metabolism in the animal body, C. LEHMANN (*Arch. Physiol. [Pflüger], 112 (1906), No. 7–8, pp. 339–351, pl. 1*).—Powdered asparagin and asparagin pressed into small tablets which were coated with celluloidin were compared as a part of the ration in experiments with a dog, the celluloidin being used to retard the action of the digestive juices. The conclusion was reached that when such action was hindered amids exercised a decided and favorable effect on nitrogen metabolism.

The author points out that in earlier experiments in which asparagin has been mixed directly with the feed and so taken in a form in which it was immediately soluble unfavorable results have been obtained and that, when asparagin occurs normally in feeding stuffs, it is inclosed in cells or is distributed in a large bulk of feeding stuff so that it is very slowly available to the bacteria which convert it into complicated nitrogenous compounds.

The utilization of beet tops and leaves in the feeding of farm animals, P. DIFFLOTH (*Soc. Aliment. Rationn. Bétail, Compte Rendu 10. Cong., 1906,*

pp. 45–56).—A summary of data in which the feeding value of beet tops and beet leaves is pointed out.

Ensiling beets and beet pulp, L. MALPEAUX (*Soc. Aliment. Rationn. Bétail, Compte Rendu 10. Cong., 1906, pp. 9–43*).—The experiments reported and discussed have to do with the ensiling of beets and beet products, the extent and character of the losses sustained, and related topics.

According to the author, whole beets when ensiled may be kept in good condition, but, if kept for a long time, sustain a considerable loss, partly owing to the fermentation of carbohydrates and partly to the oxidation of organic material, which is transformed into carbon dioxid and volatilized. Cellulose is not the seat of such changes. Nitrogenous material is not lost, but becomes differently distributed, the albumins diminishing and the nonalbuminoid compounds increasing.

Sliced beets, chopped beets, and beet pulp sustain large losses when ensiled and mixing some absorptive material, like chopped hay, with the beet products does not remedy the matter. Drying is regarded as preferable for the chopped beets. In the case of the beet pulp, in the author's opinion, as much as possible should be fed while it is fresh.

Our lupines as a feeding stuff for farm animals (*Bol. Soc. Agr. Mexicana, 31 (1907), No. 5, pp. 83–86*).—Analyses of lupines are given and the feeding value of these legumes discussed.

Gram as a stock feed (*Rhodesian Agr. Jour., 4 (1906), No. 1, pp. 56, 57*).—Gram (*Cicer arietinum*) is regarded in India as next to oats as a feed for horses, mules, sheep, and donkeys. It should not be fed until it is at least a month old and as it is very hard it should not be given whole to animals unless soaked. "The morning and midday rations should soak all night, and the evening feed from early morning until required." The soaked material should be allowed to drain for half an hour before feeding, otherwise horses will sweat badly. Gram may also be ground, and in this case should be soaked for an hour and a half before feeding. "This softens the grain without causing it to ferment. Ground gram should never be soaked like the whole grain, as it ferments in the stomach when this is done, which means death to the horse or any other animal." Ten lbs. of gram per day is regarded as an ample ration for the small Rhodesian horses and is the amount fed to cavalry horses in India. Salt should always be fed with gram.

Grape marc as a feeding stuff, H. ASTRUC and E. BOUCOIRAN (*Rev. Vit., 26 (1906), No. 673, pp. 515–522*).—On the basis of experience and a summary of data recorded by other investigators, the feeding value of grape marc is pointed out.

Congress for the rational feeding of farm animals, proceedings (*Soc. Aliment. Rationn. Bétail, Compte Rendu 10. Cong., 1906, pp. 57–86*).—Routine business was transacted and papers were presented and discussed, among which were the following: The Use of Forage Crops which Generate Hydrocyanic Acid and the Seeds of Indian Vetch for Feeding Stuffs, by Mallevré, and The Employment of Denatured Sugar as a Feeding Stuff for Farm Animals, by Vivien. The author designated a mixture of sugar with a concentrated feed like corn meal and salt as "denatured sugar."

Types and breeds of farm animals, C. S. PLUMB (*New York and London: Ginn & Co., 1906, pp. X+563, pl. 1, figs. 256*).—This important volume, which is designed for the needs of live stock students, discusses breeds of horses, asses, mules, cattle, sheep, goats, and pigs. The better known breeds are discussed in more detail than those which are less well known, and a number of the breeds included, for instance, the ass, mule, and the Angora and milch goats, have not

generally received attention in text-books in English. A wide range of literature has been consulted in the preparation of the volume, and the discussion of each breed is followed by a list of reference works.

"During the past 20 years a great amount of evidence bearing on breed merit has been secured at the agricultural experiment stations, at expositions, on race courses, and at fair grounds. In the breed reviews in this work much of this recent evidence is given a place. Brief consideration is also given to some of the more important foundation families or tribes, and to individual animals that have made a deep impression upon the breed. The author has taken the liberty of commenting on the weak as well as on the strong points of the breeds, but this has been done in a nonpartisan spirit, in harmony with the views of capable critics.

"These brief studies of the types and breeds of farm animals are naturally far from complete. They are intended for the student or the stockman who sees the long road of education before him. The subject-matter is arranged with some regard to systematic grouping, with the hope that it may in a measure meet the requirements of the class room, the teacher, and the practical stockman on the farm."

The volume as a whole constitutes an important summary of available data regarding types and breeds of farm animals, and will prove generally useful to readers interested in the subject as well as to students of agriculture.

Farm animals in Montenegro, Bosnia-Herzegovina, and Dalmatia, A. Pirocchi (*Ann. Agr. [Italy], 1906, No. 246, pp. 155, figs. 34*).—A summary of statistical and other data regarding the production and management of farm animals in the Balkan states.

Balanced rations and the influence of nitrogen equilibrium on gains made by sheep, J. Fabre (*Ann. École Nat. Agr. Montpellier, n. ser., 6 (1906), Nos. 1, pp. 66–80, dgms. 2; 2, pp. 81–89*).—The digestible nitrogen supplied in the different experiments ranged from about 6 to 37.1 gm. per head per day. The balance of income and outgo of nitrogen was determined in the experiments and variations in weight were recorded. It was found that the rations furnishing the larger amounts of protein induced greater gains of nitrogen and larger gains in body weight.

Crossbreeding for mutton in the north of England, W. T. Lawrence (*Jour. Bd. Agr. [London], 13 (1906), No. 9, pp. 513–520, figs. 3*).—The general subject of crossbreeding mountain sheep for the production of mutton is discussed and some recent tests carried on by the author are briefly referred to.

In one test the Oxford-cross lambs matured more quickly and were less expensive than the other crosses. In the second test the Border-Leicester cross was regarded as preferable for fat lambs, though the Wensleydale cross was more satisfactory for the production of rapidly growing sheep for subsequent fattening.

As the author points out, "the wether lambs of the pure mountain breeds are allowed to take their time to grow and fatten on their native fells and do not come into the mutton market except as shearlings or two-shear sheep. A Herdwick two-shear fat wether is the acme of mutton production for quality and flavor."

The digestibility of barley grits by-products, F. Barnstein and J. Volhard (*Landw. Vers. Stat., 65 (1906), No. 3–4, pp. 221–236*).—Using 2 sheep the digestibility of so-called barley feed meal, barley bran, and a by-product containing a very large proportion of the hull was studied. The basal ration was made up of meadow hay and cotton-seed meal and the digestibility of the feed-

ing stuffs under consideration was calculated in the usual way. The average coefficients of digestibility follow:

Digestibility of barley by-products—Experiments with sheep.

	Dry matter.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Barley feed meal	90.7	72.2	37.5	99.3	....
Barley bran	76.7	84.6	87.2	86.0	20.3
Barley hull feed	67.4	88.7	97.6	73.1	31.2

The Arab horse, S. BORDEN (*New York: Doubleday, Page & Co., 1906, pp. XX+104, pls. 24*).—In his summary and discussion of data regarding Arab horses, the author has considered the early history of these horses, Arab horses outside of Arabia, Arab horses in America, and related questions.

A report on the horse-breeding industry of Wisconsin, A. S. ALEXANDER (*Wisconsin Sta. Bul. 141, pp. 162, figs. 39*).—The present condition of the horse-breeding industry is discussed as well as the effects and defects of the Wisconsin stallion law. The State law is quoted, with recommendations for new legislation. A directory is included of owners of licensed stallions, and a list of American and foreign stud books, as well as samples of the score cards used in the department of horse breeding at the Wisconsin College of Agriculture.

The State breeding-stock law, in the author's opinion, should be revised and should demand, among other things, the annual or biennial renewal of a license fee, and the adoption of a list of diseases to be considered "hereditary, transmissible, or communicable" and which would subject a stallion to rejection as unsound. Specific authority should be given for the department of horse breeding to refuse license to stallions known to be unsound and to revoke licenses granted to stallions since found to be unsound. There should also be authority to revoke the license of "scrub" stallions of "unknown breeding" and to refuse licenses to such horses in the future. The law should provide for State veterinary inspectors to inspect public service stallions and require State veterinary inspection of all stallions already granted licenses on the affidavit of the owner.

The use of artichokes as a feeding stuff for work horses, MAGEN (*Soc. Aliment. Rationn. Bétail, Compte Rendu 10. Cong., 1906, pp. 87, 88*).—Having noted that the peasants in southern France are in the habit of feeding Jerusalem artichoke tubers to work horses the author studied the feeding value of this material and obtained satisfactory results with a number of draft animals. In his opinion not over 12 liters of chopped artichokes should be fed. The artichokes were mixed with crushed grain and 10 to 15 liters of chopped hay which absorbs the moisture.

According to the author, when artichokes were thus substituted for barley or oats for 100 days no unfavorable results were noted. The ration is recommended as being very economical, both on account of the small value of the land on which the artichokes are grown and the ease with which the plant may be cultivated.

An approximate law of fatigue in the speeds of racing animals, A. E. KENNELLY (*Proc. Amer. Acad. Arts and Sci., 42 (1906), No. 15, pp. 275–331, figs. 15*).—As the author points out, an athlete, whose limit of racing speed is 100 yds. in 10 seconds, that is, who is physically exhausted by such an effort, can not run 200 yds. in 20 seconds. The fastest rate which can be maintained in order to complete the longer run, that is, which will just produce exhaustion at the end of the 200 yds., is obviously lower, and it is this value which the author has sought to determine by a study of various national and international racing

records and similar data collected for trotting, pacing, and running horses, as well as for men running, rowing, skating, and swimming.

From the data summarized a number of general deductions are drawn, from which the following are quoted:

"The time varies approximately as the ninth power of the eighth root of the distance. Doubling the distance means increasing the time 118 per cent.

"The time occupied in a record-making race varies approximately inversely as the ninth power of the speed over the course. Doubling the speed cuts down the racing time 512 times.

"The distance covered increases approximately as the eighth power of the ninth root of the time. Doubling the time of the race allows of increasing the course length by 85 per cent.

"The distance covered increases approximately as the inverse eighth power of the speed over the course. Doubling the speed cuts down the distance that can be covered 256 times.

"The speed over the course varies approximately as the inverse eighth root of the distance. Doubling the distance brings down the speed about 9.3 per cent.

"The speed over the course varies approximately as the inverse ninth root of the racing time."

The mule and its uses, J. L. JONES (*Breeder's Gaz., 50 (1906), No. 8, pp. 325–327, figs. 2; 9, p. 367; 10, pp. 414, 415; 14, pp. 650, 651, figs. 2; 26, pp. 1418, 1419, figs. 3*).—The history of mule raising, methods of breeding, feeding, care and management of mules, and related questions are discussed on the basis of experience. According to the author, unshelled corn, ground barley, shelled oats, bran, corn, and similar materials are satisfactory feeds for mules and should be used in conjunction with hay and corn forage. Salt should be given regularly. Hulled oats and bran are regarded as essentials for fattening mules and for producing a fine coat.

Animal food for poultry, H. DE COURCY (*Jour. Bd. Agr.* [*London*], *13 (1906), No. 8, pp. 457–461*).—The value of different sorts of animal feed and related questions are considered.

"Fowls kept in confined runs should have an ample supply of animal food. This is not only necessary in order that they may lay good number of eggs, but also to prevent egg eating and feather pulling. These depraved habits are usually indulged in by fowls which are confined and fed on too carbonaceous a diet. In such conditions, fowls have an insatiable craving for animal food, or, in other words, for more protein, and they strive to satisfy the desire by eating their own eggs and plucking out and swallowing the feathers from each other's bodies."

The ostrich feather industry (*Brit. Trade Jour., 45 (1907), No. 529, pp. 17–19, figs. 4*).—Breeding, feeding, and handling ostriches, feather plucking, and related questions are discussed. On the basis of personal experience, the author states that the eggs are very satisfactory for food purposes, being usually cooked in the form of omelettes. A native method is to cook the whole egg in the hot ashes of a fire built in a shallow hole in the ground.

DAIRY RMING—DAIRYING—AGROTECHNY.

Feeding experiments with milch cows, J. HANSEN (*Landw. Jahrb., 35 (1906), Sup. 4, pp. 327–369*).—Various feeding stuffs were compared in tests with 10 cows covering a period of 149 days. The work is a continuation of experiments previously noted (E. S. R., 17, p. 901).

Among the conclusions reached are the following: Feeding stuffs exert a

specific influence on milk production independent of the amount of nutrients they contain. This is manifested to some extent in the yield of milk, but more particularly in the fat content of the milk. The yield of milk is less favorably influenced by sesame cake, poppy-seed cake, and cotton-seed meal than by peanut cake, and more favorably by rape-seed cake than by peanut cake. Cocoanut cake, palm-nut cake, linseed cake, and peanut cake have about the same influence. None of the differences, however, are considered of importance.

The percentage of fat in the milk is increased by palm-nut cake, cocoanut cake, and cotton-seed meal, and decreased by poppy-seed cake as compared with peanut cake. Linseed cake, sesame cake, and rape-seed cake have the same influence as peanut cake. Rice meal exerts an unfavorable influence on the fat content of the milk.

As compared with peanut cake the daily yield of fat was, therefore, increased by cocoanut cake, palm-nut cake, linseed cake, cotton-seed meal, and rape-seed cake, and decreased by sesame cake, poppy-seed cake, and rice meal.

Demonstration experiments on the feeding of dairy cows, conducted at the expense and under the supervision of the government during the winter of 1905–6 (*Bul. Agr. [Brussels], 22 (1906), No. 6, pp. 657–822*).—This is a detailed report of numerous feeding experiments carried out in the different provinces of Belgium in the same manner as in previous years (E. S. R., 17, p. 693).

Feeding experiments with dried beet leaves, W. WREDE (*Deut. Landw. Presse, 34 (1907), No. 5, p. 32*).—This material was compared with brewery residue in a test with 51 cows lasting 21 days, the results indicating that 1 kg. of the residue may be replaced by 1.5 kg. of the dried beet leaves. The dried leaves were also compared with beet-leaf silage in a test with 49 cows lasting 32 days, the results indicating that 1 kg. of the former is equivalent to 5 kg. of the latter.

The influence of the condimental feed Enzymol upon the milk production of cows, M. DURÉ (*Ztschr. Landw. Versuchsw. Österr., 9 (1906), No. 11, pp. 1003–1014*).—In tests with 6 cows this material apparently prepared from yeast tended in nearly every instance to decrease the yield of milk. It was without influence upon the fat content of the milk, the amount of other feed consumed, or the live weight of the animals.

Tests of Swiss, Simmental, and East Friesian cows, J. HANSEN (*Landw. Jahrb., 35 (1906), Sup. 4, pp. 147–326, pls. 6*).—This is a detailed report of tests of 13 Swiss, 12 Simmental, and 14 East Friesian cows. The Swiss cows weighed on an average 567 kg. and produced during 1 year 5,150.01 kg. of milk and 185.33 kg. of fat; the Simmental cows weighed 659 kg. and produced 5,565.22 kg. of milk and 225.42 kg. of fat; and the East Friesian cows weighed 559 kg. and produced 6,451.75 kg. of milk and 199.31 kg. of fat. The data obtained are discussed from various standpoints and compared with similar data for other breeds.

Milk production and breast girth, E. SCHNABEL (*Österr. Molk. Ztg., 14 (1907), No. 1, pp. 2, 3*).—Comparing cows of the same age and stage of lactation a higher yield of milk was associated with a greater breast measure in 23 out of 34 comparisons and with a smaller girth in 7 comparisons. In 4 comparisons the girth was the same, but the yield different.

The development of the testing of cows by control associations, PETERSEN (*Illus. Landw. Ztg., 27 (1907), Nos. 5, pp. 29–32; 6, pp. 37, 38*).—This is a discussion of the progress made in Germany along this line.

The milking machine as a factor in dairying (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 92, pp. 55, pls. 4, figs. 6*).—This is a preliminary report on investi-

gations of the milking machine from the standpoints of actual practice and of bacteriology.

Practical studies of a milking machine, by C. B. Lane (pp. 9–32).—The author describes several milking machines, gives estimates of the cost of equipment for machine milking, reports in detail two experiments in which hand milking and machine milking were compared, discusses the effects of milking machines upon the cows and other problems, and in conclusion summarizes the results of experience with milking machines as reported by dairymen.

The first test reported was made with 8 cows and lasted 30 days. The herd of 13 cows from which the 8 were selected had been milked with machines for over 3 years. The second test, lasting 20 days, was made with 20 cows selected from a herd of 65 with a view to securing cows of different kinds, including hard and easy milkers, heifers and mature animals, cows in the first and last stages of lactation, and cows of nervous temperament.

In the first test the time required for milking 4 cows twice daily by hand averaged 40.59 minutes and by machine 26.59 minutes. The difference in yield of milk, not including strippings, was 3.9 per cent in favor of machine milking. Hand milking was less thorough than machine milking as an average of 4.55 oz. of strippings per cow for each milking was obtained in the former case, and 4.12 oz. in the latter.

In the second test the time required for milking 10 cows twice daily by hand averaged 154.9 minutes and by machine 37.07 minutes. The difference in yield of milk, not including strippings, was 7.59 per cent in favor of hand milking. The strippings per cow at each milking averaged 2.7 oz. in case of hand milking and 3.4 oz. in case of machine milking. The average fat content of hand-drawn milk was 3.77 per cent and of machine-drawn milk 3.49 per cent.

The author offers a number of suggestions for the improvement of milking machines and points out the objections and difficulties to their use as well as their advantages. The need of further investigation is emphasized.

The experience of 11 dairymen who made reports was favorable to machine milking as compared with hand milking.

Bacteriological studies of a milking machine, by W. A. Stocking, jr. (pp. 33–55).—The results are summarized by the author as follows:

"(1) Unless sufficient care is used in cleaning the machines, decaying milk and bacteria accumulate in the rubber tubes and contaminate the milk as it passes through them.

"(2) The few dairymen now using these machines are not exercising sufficient care in washing and sterilizing the machines to keep them in sanitary condition; their milk is therefore of poorer quality from the sanitary standpiont than that drawn by hand under the same stable conditions.

"(3) Good sanitary conditions in a stable may be completely counteracted by the insanitary condition of the milking machine.

"(4) When kept in fairly clean condition the machine-drawn milk contains decidedly smaller numbers of bacteria than the corresponding hand-drawn milk.

"(5) When the machines are not well cleaned both the number and percentage of acid-producing bacteria are higher than in the hand-drawn milk, but when they are fairly well cleaned both the total number and the percentage of these bacteria are decidedly lower than in the corresponding hand-drawn milk.

"(6) Both the total number and the percentage of liquefying bacteria found in the milk were in most cases greatly reduced by the use of the machines. This fact is of special significance in milk designed for direct consumption.

"(7) When properly cared for, drawing the milk by means of the machine increases its keeping quality.

"(8) Washing the machines with cold water and then with hot water containing sal soda is not sufficient to keep the rubber tubes clean. Under this treatment the inside of the tubes becomes coated with decaying milk, thus forming ideal conditions for the multiplication of various species of bacteria.

"(9) Scalding the machines by pumping boiling water through them just before use had little or no effect in reducing germ content of the milk.

"(10) Boiling in clear water for three-quarters of an hour was not sufficient to keep the rubber tubes in a sterile condition.

"(11) Subjection to steam without pressure for 30 minutes was not sufficient to sterilize the rubber tubes.

"(12) Placing the rubber parts in brine for several hours after being washed reduced the germ content of the machine-drawn milk to about one-half that of the milk drawn by hand.

"(13) Boiling in water containing a small amount of powdered borax had about the same effect in reducing the bacterial content of the milk as did the brine treatment, but the use of borax is dangerous unless extreme care is exercised.

"(14) The machines may be very effective in the production of sanitary milk if they are properly cleaned and sterilized.

"(15) The results of these experiments indicate that the machines may be kept in such an insanitary condition that the keeping quality will not be improved, but may be seriously impaired. They also indicate that with properly cleaned and sterilized machines the keeping quality of the milk may be very materially improved."

The variation in the composition of milk, A. LAUDER (*Edinb. and East of Scot. Col. Agr. Bul. 11, pp. 52*).—Causes of variation in the composition of milk are briefly discussed, and the results of a systematic examination of the milk of two well-kept private dairy herds in the East of Scotland are reported. The investigation with one herd of 22 cows began in May, 1905, and is being continued. Another herd of 30 cows was tested from June to October, 1905. Both herds were of the dairy Shorthorn type.

The average composition of the mixed milk of the smaller herd for 1 year was 12.34 per cent of total solids and 3.15 per cent of fat for the morning's milk, and 12.96 per cent of total solids and 3.91 per cent of fat for the evening's milk. The cows were milked at 6.30 a. m. and 4 p. m. During the months of February, March, and April, the milk of individual cows fell below the legal standard of 3 per cent of fat 99 times in the morning and 45 in the evening. When the cows were milked at equal intervals for a short period the differences in percentages of fat and total solids between the morning's and evening's milk were much reduced. Increasing the amount of feed had practically no effect on the fat content of the milk.

The average composition of the mixed milk of the other herd was 12.83 per cent of total solids and 3.95 per cent of fat for the morning's milk and 12.77 per cent of total solids and 3.88 per cent of fat for the evening's milk, but here the intervals between milkings were equal.

Opsonins in milk, G. S. WOODHEAD and W. A. MITCHELL (*Jour. Path. and Bact., 11 (1907), No. 4, pp. 408-414*).—Using human leucocytes the opsonic index of the blood of a nontuberculous cow was found to be 0.8 and that of the milk 0.6. The figures in another case were, respectively, 0.96 and 0.57. The milk of an apparently healthy cow showed an opsonic index of 2.2, while the indices of the milk of 3 cows in a comparatively low state of health were, respectively, 0.51, 0.44, and 0.48. The opsonin content of whey prepared by either rennet or hydrochloric acid was found to be greater than that of an equal volume of

milk, indicating, in the opinion of the authors, that the gastric secretions are not likely to lower the activity of the opsonins. The opsonic indices of milk, rennet whey, and whey prepared by adding hydrochloric acid in several experiments were, respectively, 0.72, 1.03, and 1.2.

It is considered possible that the high opsonic index of milk may play an important part in protecting young children against tuberculosis.

The heat value of milk as a test of its quality, J. MALCOLM and A. A. HALL (*Jour. Agr. Sci., 2 (1907), No. 1, pp. 89–95*).—Experiments were conducted to determine the value of the direct estimation of the caloric value of milk by combustion in a bomb calorimeter as a practical means of judging the quality of milk. The process is said to require little chemical knowledge, to be easily learned, very accurate, and to occupy a relatively short time.

The results show a general relationship between the percentages of fat or total solids and the caloric value. The method is, therefore, considered an important means of detecting the removal of fat and estimating total solids. It is suggested that the legal definition of milk might be improved by the adoption of a minimum caloric value. While the determinations so far made are too few for establishing a standard, it is estimated that in order to correspond with the present legal standard in Great Britain it should not be below 650 calories per cubic centimeter, or 5,650 calories per gram of solids.

Fermentation of milk, F. BLUMENTHAL and WOLFF (*Abs. in Jour. Chem. Soc. [London], 90 (1906), No. 530, p. 879*).—It is stated that milk kept for years may contain 50 per cent of the lactose originally present. Proteids are not peptonized in spontaneous acid fermentation, but large amounts of amino acids are formed. Tryptophan is also present. Prolonged putrefaction increases the lactic acid more than the succinic acid.

Comparative investigations on the lactic-acid bacteria of the Bacterium güntheri type from different sources, L. MÜLLER (*Centbl. Bakt. [etc.], 2. Abt., 17 (1906), Nos. 14–16, pp. 468–479; 19–21, pp. 627–643; 17 (1907), No. 22–24, pp. 713–755*).—With one exception, the several cultures of *Bacterium güntheri* studied showed no essential difference in morphological or cultural characteristics.

The prolonged culture of these organisms on a suitable medium failed to influence to any marked extent their acid-producing power. A close relationship was observed between *B. güntheri* and *Streptococcus agalactiæ* as regards morphology and ability to ferment different sugars. When grown on certain media, *B. güntheri* resembled the streptococcus and when grown on other media the reverse was true. This explains, according to the author, the frequency with which the two forms have been confused. A streptococcus isolated from mastitis assumed in cultures forms resembling in different degrees lactic-acid bacteria.

Some investigations and observations on lactic-acid bacteria, T. GRUBER (*Centbl. Bakt. [etc.], 2. Abt., 17 (1907), No. 22–24, pp. 755–760*).—Studies of a number of cultures of lactic-acid bacteria isolated from dairy products are briefly reported. The morphological and cultural characteristics heretofore used in distinguishing forms of lactic-acid bacteria are considered of little value. It is considered important to determine the behavior of the different races of lactic-acid bacteria toward milk sugar, dextrose, mannite, maltose, etc.

Aroma-producing bacteria in milk, J. VAN DER LECK (*Centbl. Bakt. [etc.], 2. Abt., 17 (1906), Nos. 11–13, pp. 366–373; 14–16, pp. 480–490; 19–21, pp. 647–660*).—The author reports an extended study of *Bacillus aromaticus* in comparison with other organisms, from which he concludes that this bacillus plays an important rôle in the ripening of soft cheese. The work is being con-

tinued. Methods of studying this subject and results obtained by other investigators are discussed.

A note on the coagulation of milk by Bacillus coli communis, C. J. O'HEHIR (*Jour. Path. and Bact., 11 (1907), No. 4, pp. 405-407*).—Experiments by the author confirm the view previously expressed that the coagulation of milk by *Bacillus coli communis* is due to the production of an acid, presumably lactic, by the bacteria. While the subsequent formation of an enzym rendering the coagulum insoluble may be common it is not considered universal.

Development of factory dairying in Wisconsin with map showing location of cheese factories and creameries, H. L. RUSSELL and U. S. BAER (*Wisconsin Sta. Bul. 140, pp. 18, pl. 1, map 1*).—The station has issued at intervals of 5 years a map of Wisconsin upon which is marked the location of each factory in the State. The series, therefore, furnishes valuable data concerning the growth of the industry.

The bulletin which the present wall map accompanies discusses the relation of factory development to dairy development, the causes of the reduction in the number of creameries, the growth and output of cheese factories, and the regions of marked dairy factory activity which are designated the Swiss-cheese region, Richland County Cheddar region, Cheddar region of lake-shore and adjacent counties, brick cheese region of Dodge County, butter center of southeastern Wisconsin, and the new dairy region of central Wisconsin.

"While a study of this sort can not be taken as final evidence of the state of dairy development, a comparative study of the growth of creameries and cheese factories during the last five years shows a progressive development that bespeaks a healthy condition for the dairy industry. During the last 5 years the number of cheese factories has increased about 7 per cent, aggregating now 1,649 with 40 factories in addition that make both cheese and butter. The creameries have diminished some in number, because of the extension of the operating radius of the creamery through the conversion of many creameries into skimming stations. The introduction of the farm separator, and the natural centralization or syndicating of factories have been the main causes for the reduction of creameries. There are now 1,017 creameries and 260 skimming stations. . . .

"On the whole, factory growth is going on rapidly throughout most regions of the State. Not only is the number actually increasing, but the average output is much larger than formerly, while the aggregate amount of dairy products manufactured has increased in the last 5 years over one-half in the case of butter, and has nearly doubled in the case of cheese."

Efficiency of cream separators under farm conditions, I. P. WHITNEY (*Oregon Sta. Bul. 89, pp. 3-10*).—Notes are given on the history of the cream separator and its efficiency with special reference to farm conditions is discussed. Comparative tests of different separators conducted in the fall and again in the spring are reported.

The author concludes that the farm cream separator is a thoroughly practical machine and much more effective than any of the gravity methods. The separation of the cream was more thorough in the spring when the cows were pastured, than in the fall when fed dry feed. The average fat content of skim milk under the two conditions was respectively 0.02 and 0.045 per cent. The different sizes of separators were about equally efficient. No information of particular value regarding the durability of the different separators was secured.

Dairy school cream separator tests, F. L. KENT (*Oregon Sta. Bul. 89, pp. 10-17, figs. 7*).—Tests of 7 makes of cream separators by students during 4

years are reported, as are also similar tests by the author, assisted by W. W. Grant, special dairy instructor, made with a view to securing data regarding the accuracy of the students' tests. The results showed that it would be necessary to separate about 5,000 lbs. of milk in order to make a difference of 1 lb. of fat, lost in the skim milk between the most efficient and the least efficient machine tested. Notes are also given on the advantages and disadvantages of the machines.

The hand separator and the gravity systems of creaming, O. F. HUNZIKER (*Indiana Sta. Bul. 116, pp. 341–364, figs. 10*).—The purpose of the work reported in this bulletin, as stated in the introduction, was to determine the skimming efficiency of the various systems of creaming; to study the effect of these systems on the quality of the cream and skim milk; to determine the influence of such factors as the steadiness of running and the care of the machine, the speed of the bowl, the temperature and physical condition of the milk, the rate of inflow and the richness of the cream, on the skimming efficiency of the hand separator; and to point out to Indiana dairymen those methods and conditions that will reduce the loss of butter fat in skim milk to the minimum and improve the quality of the cream.

The author summarizes the results obtained as follows:

"The use of the hand separator in the place of the gravity systems of creaming will effect a saving of $3.50 to $7 worth of butter fat from one cow in one year.

"With the hand separator a richer cream and a better quality of cream and skim milk can be produced than with the gravity systems.

"Of the gravity methods the deep setting system is the least objectionable. It produces a more complete separation and a better quality of cream than either the shallow pan or the water dilution systems.

"Any neglect to thoroughly clean the separator after each separation reduces the skimming efficiency of the machine and lowers the quality of the cream and butter produced. Wash the separator after each separation.

"A trembling machine, insufficient speed, sour, curdled, slimy, or cold milk, and overfeeding the separator caused a loss of butter fat in the skim milk amounting to from 8 to 12 lbs. of butter per cow in one year.

"Other things being equal, high speed and a small rate of inflow tend to produce a thick cream. Insufficient speed, a trembling machine, and a large rate of inflow result in a thinner cream."

On the evolution of gas during churning, R. D. WATT (*Jour. Agr. Sci., 2 (1907), No. 1, pp. 96–99*).—According to the author's conclusions a considerable quantity of carbon dioxid is produced by bacteria during the ripening of cream. This gas which is held in a state of supersaturation is liberated to a large extent during the beginning of the churning process. The amount of carbon dioxid produced was found to bear no very constant relation to the lactic acid or to the total acidity.

The constants of bog-butter found in the peat of Ireland, L. G. RADCLIFFE and W. H. MADDOCKS (*Jour. Soc. Chem. Indus., 26 (1907), No. 1, p. 3*).—The analyses of 2 samples reported show the changes undergone by butter preserved, possibly for centuries, in peat water.

On the cause of a brown-red coloration of hard and soft cheese, T. GRUBER (*Centbl. Bakt.* [*etc.*], *2. Abt., 17 (1907), No. 22–24, pp. 761–764*).—The author gives the morphological and cultural characteristics of *Bacterium casei fusci*, which was found to be the cause of this fault in cases under investigation.

On some phenomena observed in the peptic digestion of caseins, J. H.

LONG (*Jour. Amer. Chem. Soc., 29 (1907), No. 2, pp. 223–230*).—Preparations of casein from cow's milk and goat's milk were compared as regards their digestibility with pepsin and dilute hydrochloric acid. The two forms were found to be very much alike in general behavior. The artificial digestion of the casein from goat's milk was much slower than that of the casein from cow's milk. Other points of difference were observed, the most marked of which was the larger amount of the so-called pseudo-nuclein obtained from the casein from goat's milk.

The fermentations of casein and their applications, A. RODELLA (*Arch. Hyg., 59 (1906), No. 4, pp. 337–354, pls. 2*).—The author maintains as the result of his investigations that the fermentations of casein are dependent upon anaerobic bacilli. These give rise to a large number of products, including volatile fatty acids. Aerobic bacteria, such as *Bacillus subtilis, B. megatherium*, and *B. mycoides*, may, however, decompose casein, but no volatile fatty acids are produced.

The anaerobic fermentation of casein is marked by the appearance of a black color, due to the formation of an inorganic compound containing iron and sulphur, although this may not appear if the medium is acid. The control of anaerobic fermentation in cheese ripening by the addition of acid or salt is therefore desirable. The significance of aerobic tyrothrix forms in the ripening of cheese is considered entirely different from that of the anaerobic forms, and the two classes of organisms should not, therefore, be grouped together. It is suggested that a satisfactory classification of the different varieties of cheese might be based upon anaerobic fermentations.

Casein: Its preparation and technical utilization, R. SCHERER, trans. by C. SALTER (*London: Scott, Greenwood & Son; New York: D. Van Nostrand Co., 1906, pp. XV+168, figs. 11*).—This is the translation of the German edition to which reference has already been made (E. S. R., 17, p. 400). The book deals with the preparation and properties of casein and its use as a painting material, as a mucilage or cement, as a substitute for horn, ivory, celluloid, etc., as a dressing for textiles, as a foodstuff, and for other purposes. A summary is also given of the known compounds of casein.

Annual report on the investigations and progress in sugar making, J. BOCK (*Jahresber. Zuckerfabrik. [Stammer], 45 (1905), pp. X+321*).—This report for 1905 is similar in character to the preceding one (E. S. R., 17, p. 907).

Cane juice defecation, 1905, W. L. BASS, trans. by S. F. DE VELASCO (*New York: Polydore Barnes Co. Press, 1905, pp. 205, pls. 2, figs. 39*).—This subject is treated in simple language for the use of managers and others engaged in practical sugar making. The text is in both English and Spanish.

The influence of sulphurous acid, free and in combination with acetaldehyde, on the different organisms in wine, W. SEIFERT (*Ztschr. Landw. Versuchsw. Österr., 9 (1906), No. 12, pp. 1019–1059*).—This gives the results of an extended investigation on the amount of sulphurous acid free and in combination with acetaldehyde in wine resulting from fumigation with sulphur fumes, and the influence of each form on yeast, fungi, and acetic-acid bacteria.

The methods of examination and the organisms of vinegar and the materials from which made, F. ROTHENBACH (*Die Untersuchungsmethoden und Organismen des Gärungsessigs und seiner Rohstoffe. Berlin: Paul Parey, 1907, pp. XII+237, figs. 118*).—The first part of this treatise takes up some of the elementary principles of chemistry and then details methods for such determinations as alcohol and acetic acid. The second part describes the organisms concerned in vinegar making and discusses their use.

VETERINARY MEDICINE.

Special pathology and therapy of domestic animals, F. HUTYRA and J. MAREK (*Spezielle Pathologie und Therapie der Haustiere. Jena: Gustav Fischer, 1905, vol. 1, pp. XI+873, pls. 3, figs. 132; 1906, vol. 2, pp. X+971, figs. 138*).—The basis of this work was first published in Hungarian by the senior author.

In its present form it covers in great detail the essential points in connection with all of the common diseases affecting farm animals. The subject matter is arranged according to the usual systematic plan, viz, infectious diseases of general, exanthematic, or local character, and of an acute or chronic nature, whether caused by bacteria or protozoa, and organic diseases classified according to the part or structures affected. The etiology, pathology, and treatment of these diseases are thoroughly discussed and well illustrated.

Notes on blood-serum therapy, preventive inoculation, and toxin and serum diagnosis for veterinary practitioners and students, W. JOWETT (*Chicago: W. T. Keener & Co., 1907, pp. VII+204, figs. 47*).—The subjects discussed in this volume have, within recent years, assumed such importance and made such great advancement in practical application in the diseases of animals that a handbook covering the technical details of this work was needed for laboratory investigators and veterinary practitioners.

The present volume contains an account of the three prominent theories of immunity, methods of conferring immunity, diseases due to ultravisible virus, diseases caused by the protozoa, and diagnosing by means of toxins and serums. The essential points are presented in a remarkably clear and concise manner and convey effectively the information which the laboratory worker or practitioner needs along this line.

Killing and attenuating micro-organisms by chemically indifferent bodies, E. LEVY ET AL. (*Centbl. Bakt. [etc.], 1. Abt., Orig., 42 (1906), No. 3, pp. 265–270*).—In most schemes of attenuation materials or methods are used which may change the chemical composition of the bacteria and may, therefore, render them less capable of exercising a vaccinating effect. The authors therefore decided to test the effect of indifferent bodies in attenuating bacteria without changing their chemical composition or interfering with their vaccinating powers. For this purpose sugar and glycerin were selected, preference being given to sugar on account of the fact that the bacteria in a sugar solution could be readily dried at any desirable time.

It was found in the experiments carried out by the authors that the attenuating effect of either sugar or glycerin was considerably increased by maintaining the cultures in an apparatus in which they could be continually shaken. In working with tubercle bacilli it was found that a temperature of 37° C. in an 80 per cent solution of glycerin was sufficient to produce a pronounced attenuation within 5 days. Guinea pigs were inoculated with tubercle bacilli which had been treated in this way and subsequently received cultures treated for shorter periods ranging from 4 days down to 1 day. Animals treated in this way were found to be immune to fatal doses of virulent tubercle bacilli.

The same method was tried with glanders bacilli, the organisms being shaken for from 13 to 72 hours in an 80 per cent glycerin solution at a temperature of 37° C. Large doses of glanders bacilli treated in this way produced a complete immunity against 4 to 5 times the fatal dose of virulent glanders bacilli. The first experiments were carried out on guinea pigs, but later 5 horses were treated in the same way and proved to be immune to glanders.

The method will be tested on a number of other pathogenic organisms.

Annual report on the distribution of animal plagues in the German Empire (*Jahresber. Verbr. Tierseuch. Deut. Reiche, 20 (1905), pp. VIII + 210, pls. 4, figs. 19*).—A discussion is presented of the extent and distribution of all the important animal diseases in the German Empire, including particularly anthrax, blackleg, rabies, glanders, foot-and-mouth disease, pleuro-pneumonia, mange, tuberculosis, and infectious diseases of hogs and poultry.

Details concerning the distribution of these diseases in different parts of the German Empire are presented in tabular form. The recent meat inspection regulations of Germany are given and a brief outline is presented of laws relating to animal diseases in various countries.

Notes from the Berlin medical clinic, E. FRÖHNER (*Monatsh. Prakt. Tierheilk., 18 (1906), No. 3-4, pp. 134-137*).—A number of cases which came under the observation of the author are reported. In one instance a case of tetanus which had developed in a horse as a result of docking was not checked by the amputation of the tail. The only result of this operation was to delay the death of the animal for a few days.

Notes are also given on intermittent lameness in horses as a result of sarcoma in the mediastinal space, on chronic nephritis following hemoglobinuria, mercuric poisoning in horses, abscesses of the spleen, and tuberculosis in the horse complicated with pneumonia. This combination of tuberculosis and pneumonia is of very rare occurrence.

Veterinary hygienic principles applicable to stock in South Africa, A. THEILER and C. E. GRAY (*Transvaal Agr. Jour., 5 (1906), No. 17, pp. 96-110, pl. 1*).—Attention is called to the highly contagious nature of sheep scab and the ravages which it has caused. An improved sheep-dipping vat is illustrated and described by T. H. Dale. Brief accounts are also presented of epizootic lymphangitis, hog cholera, and mange in horses.

New treatment of serious wounds and injuries, particularly synovial lesions by crystallized boric acid, BUSY (*Rec. Méd. Vét., 83 (1906), No. 17, pp. 623-627*).—In the author's experience the best results have been obtained from the use of pure boric acid by means of which a complete acidification and saturation of wounds and surrounding tissue are accomplished in such a way as to relieve the inflammation of the affected part. This treatment not only allays inflammation but acts as a local anesthetic and is particularly well adapted for use in cases of injury to the joints or tendons.

An apparatus for the intravenous injection of large quantities of fluids, W. FLATTEN (*Berlin. Tierärztl. Wchnschr., 1906, No. 38, pp. 697, 698, fig. 1*).—The chief features of the apparatus described by the author are a graduated glass cylinder, rubber tube, clamp for holding the apparatus firmly attached to the animal's neck, and the needle which penetrates into the blood vessel. The advantages claimed for the apparatus are that it is easily cleansed and that the operation is simple.

Tuberculosis: Its origin and extinction, W. P. TURNER (*London: Adam & Charles Black, 1906, pp. XII + 96, pls. 4, figs. 18*).—A general plan, believed by the author to be novel and original, is suggested for the eradication of tuberculosis in man and animals.

The author holds, in the first place, that tuberculosis in man is acquired always by ingestion or inoculation and never by inhalation, and that the disease is derived primarily from cattle. Cattle in turn are believed to be infected from eating forage contaminated with the tubercle bacillus. It is also maintained that the tubercle bacillus is naturally a saprophyte, and that it only becomes pathogenic when protected from the actinic rays of the sun. The author's scheme, therefore, for the total eradication of tuberculosis con-

sists simply in providing all cattle barns with glass roofs in order to expose them to the action of the sun.

The relation of tuberculous lesions to the mode of infection, E. C. SCHROEDER and W. E. COTTON (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 93, pp. 19*).—The experiments reported in this bulletin were carried out chiefly to obtain evidence as to the susceptibility of the lungs to infection with tubercle bacilli without regard to the point of inoculation. The work was in continuation of similar investigations already reported (E. S. R., 18, pp. 82, 378).

In these experiments 3 hogs and 2 calves were given subcutaneous injections of virulent tubercle bacilli in the tip of the tail. This point was selected as being farthest removed from the lungs. A study of these cases showed that the tubercle bacilli were taken up either by the capillary blood vessels or by the lymphatic system and were carried to the lungs, which became excessively diseased in all cases, while the inguinal glands, liver, and spleen were affected to a less extent.

It appears, therefore, that the inhalation theory, to explain the frequent infection of the lungs in tuberculosis, is becoming more and more unsatisfactory, and more evidence is being accumulated for the belief that tuberculous infection reaches the lung as well as other organs through tubercle bacilli taken with the food. These conclusions are believed to apply both to animals and man.

Tubercular infection, W. T. D. BROAD (*Vet. Rec., 19 (1906), No. 955, p. 252*).—The author raises an objection to the frequent statement that direct experiments in the transmission of tuberculosis from animals to man are impossible. He argues that many instances are known where such transmission has taken place through the agency of milk and considers the evidence in some of these cases as very conclusive. One instance is cited.

The investigations of Dammann and Müssemeier on the relation between human and bovine tuberculosis, H. KOSSEL (*Centbl. Bakt. [etc.], 1. Abt., Orig., 42 (1906), Nos. 5, pp. 401–405; 6, pp. 489–495*).—The author reviews in a critical manner the experimental data and the conclusions drawn from them in the investigations of Dammann and Müssemeier.

It is believed that the conclusions as to the unity of tubercle bacilli rest upon the assumed impossibility of determining constant morphological differences between tubercle bacilli obtained from different sources and also upon the apparent similarity of different races of bacilli in so far as pathogenic action is concerned. The author argues that these facts are not demonstrated and that, therefore, the conclusions as to unity of the different races of bacilli should not be drawn.

Tubercle bacilli in the apparently unaltered lymph glands of tuberculous animals, J. SWEIRSTRA (*Ztschr. Fleisch u. Milchhyg., 17 (1906), No. 2, pp. 27–42*).—In the investigations reported by the author guinea pigs, rabbits, goats, pigs, and calves were used as experimental animals. A careful examination was made of apparently normal lymph glands in these animals after they had been infected with tuberculosis, the animals being inoculated with material from the glands of hogs to determine the presence or absence of tubercle bacilli. Positive results were obtained for tubercle bacilli in 7 cattle and 2 hogs, while negative results were obtained in the case of 11 cattle and 6 hogs.

As a result of this study, the author recommends the sterilization of the meat in all cases of tuberculosis in which great emaciation is seen, in all cases with extensive softened foci, in cases showing a recent blood infection, and in tuberculosis of the bones.

Primary tuberculosis of the larynx, H. HOLTERBACH (*Deut. Tierärztl. Wchnschr.*, *14* (*1906*), *No. 44*, *pp. 541*, *542*).—Tuberculosis of the larynx in the primary form is not of common occurrence. On this account the author describes in detail an undoubted case in a cow resulting in death after 1 year and causing a complete loss of voice, which persisted for 10 months before death. The tuberculous infection in the region of the larynx was of an acute and rapidly extending nature, but there were no lesions in the lungs or even in the lymph glands in the region of the larynx.

Immobility in cattle as a result of tuberculosis, E. BESNOIT (*Rev. Vét.* [*Toulouse*], *31* (*1906*), *No. 11*, *pp. 701–710*).—Considerable attention has been given by the author to cases of tuberculosis affecting the brain and causing some form of meningitis which results in a loss of the power of motion on the part of the affected animal. In the cases which have come under his observation there were tuberculous lesions in the lungs and other organs and the cerebral symptoms were so pronounced as to indicate serious lesions in the brain.

Cases of apparent recovery from experimental tuberculosis, L. MARTIN and A. VAUDREMER (*Compt. Rend. Soc. Biol.* [*Paris*], *61* (*1906*), *No. 28*, *pp. 260–262*).—As a result of treatment with tubercle bacilli from which the fatty substances had been removed, apparent recoveries took place in rabbits, but in some cases the tubercles which apparently had healed subsequently showed virulence. The authors, therefore, recommend caution in experiments of this sort to avoid mistakes of judgment after the use of tubercle bacilli of low virulence.

The actual status of vaccination and serotherapy for tuberculosis, G. MOUSSU (*Rec. Méd. Vét.*, *83* (*1906*), *No. 21*, *pp. 741–758*).—In this article the position is taken that the views commonly expressed regarding the present methods of serotherapy for tuberculosis are much too optimistic. The author expresses the opinion that a reliable method of treatment is still to be found.

Quantitative relations of agglutination of tubercle bacilli, L. KARWACKI and W. BENNI (*Centbl. Bakt.* [*etc.*], *1. Abt.*, *Orig.*, *42* (*1906*), *Nos. 3*, *pp. 252–254*; *4*, *pp. 345–348*).—The agglutinating power of tuberculous sera for tubercle bacilli is much less than in the case of such diseases as typhoid and cholera. In general the absorption coefficient diminishes as the concentration of the serum increases. The agglutinins were apparently destroyed by heating the serum to a temperature of 100° C. diluted in 3 parts of water to which 3 per cent of glycerin had been added.

Abdominal zoogleic tuberculosis of birds, J. ROGER (*Rev. Vét.* [*Toulouse*], *31* (*1906*), *No. 12*, *pp. 761*, *762*).—Quite frequently, supposed cases of tuberculosis of the internal organs of fowls prove to be due to mites or some other organism than the tubercle bacillus. In most cases of true tuberculosis of fowls, the spleen is affected and the liver is almost invariably attacked.

Experiments with fish tubercle bacilli cultivated at a temperature of 37° C., A. AUJESZKY (*Centbl. Bakt.* [*etc.*], *1. Abt.*, *Orig.*, *42* (*1906*), *No. 5*, *pp. 397–401*).—Considerable difficulty has been experienced in getting tubercle bacilli from fish to live at a blood temperature. The author began with a medium containing potatoes and glycerin water at a temperature of 28 to 30° C. and after 6 weeks, or at the end of the fifth generation, the temperature was increased to 37° C. In the meantime the cultures had ceased to be white and glistening, as is the case with ordinary tubercle bacilli from fish, and had assumed a yellowish-gray color resembling that of the ordinary mammalian tubercle bacilli.

These bacilli after cultivation on the media maintained at a temperature of

37° C. were pathogenic for guinea pigs, producing death within 38 to 63 days. Three calves were inoculated with the same material and 2 remained healthy while the third developed a local tuberculous infection.

Chronic pseudotuberculous enteritis in cattle, B. BANG (*Berlin. Tierärztl. Wchnschr., 1906, No. 42, pp. 759–763*).—Considerable controversy has prevailed regarding the exact nature of tuberculous enteritis in cattle. It appears that the author has demonstrated its infectious nature and that it is often associated with cases of true tuberculosis affecting other organs of the body. Positive results were obtained in a number of cases by feeding portions of the mucous membrane of the intestines from animals affected with the disease. The symptoms produced in this way were identical with those which appear in spontaneous cases.

Anthrax, PROFÉ (*Fortschr. Vet. Hyg., 4 (1906), No. 7, pp. 145–149*).—The author presents a report of a conference of official veterinarians regarding the effectiveness of the laws of Prussia relating to the control of anthrax. It is recommended that the compulsory notification provision be extended to all cases in which the symptoms resemble those of anthrax. This notification should be made immediately to the police authorities and the local official veterinarian should have authority to determine the method of procedure in the case.

The spread of anthrax in animals and man, J. DUNSTAN (*Vet. Rec., 19 (1906), No. 954, pp. 236–238*).—Attention is called to the statement that anthrax appears to be on the increase during recent years. The reliability of statistics on the spread of anthrax is questioned on account of the fact that local authorities are often unwilling to report cases and incur the expense of disposing of carcasses. The symptoms of the disease are described and facts are presented relative to the intertransmission of the disease between man and animals.

The inoculability of anthrax, E. LECLAINCHE (*Rev. Gén. Méd. Vét., 8 (1906), No. 94, pp. 539–544*).—A historical account is presented of some of the early experiments which showed that anthrax could be transmitted by inoculating healthy animals with infected blood.

The action of anthrax serum, E. GOTTSTEIN (*Hyg. Rundschau, 16 (1906), No. 20, pp. 1113–1120*).—An enormous variation in the agglutinating power of different sera for anthrax bacilli has been noted by different investigators. In some cases it is claimed that agglutination took place in dilutions at the rate of 1 : 500,000. The author, however, was unable to get any positive results or to demonstrate any difference in the action of normal and immune serum upon anthrax bacilli.

East coast fever, S. B. WOOLLATT (*Natal Dept. Agr. Bul. 11, pp. 14*).—The author presents in a condensed form the most important points which have been demonstrated regarding the nature, occurrence, and treatment of this disease. It is believed that one of the chief agencies in spreading the disease is to be found in the oxen used for draft purposes and driven about the country from place to place.

Cattle tick eradication in northwest Arkansas, W. G. VINCENHELLER (*Arkansas Sta. Bul. 93, pp. 17–29, figs. 3*).—During 1906, a preliminary survey of northwest Arkansas was made by the officials of the experiment station and the Bureau of Animal Industry for the purpose of determining the extent of infestation with cattle ticks. In Benton County 7,474 cattle were inspected, of which 481 were found to be infested, while in Washington County 903 cattle were infested out of 2,003 inspected.

The slight infestation of cattle as observed in the Texas-fever regions of Arkansas indicate that the eradication of the ticks and the control of Texas

fever would be a comparatively easy problem in that State. Infestation of cattle with ticks persists by reason of driving herds in from Indian Territory and from the lack of control of cattle on the public range.

Progress made in exterminating the cattle fever tick in North Carolina, T. BUTLER (*Raleigh: N. C. Dept. Agr.* [*1907*], *pp. 5, figs. 3*).—The author calls attention to the progress which has been made since 1902 in exterminating cattle ticks in North Carolina.

During the past 5 years 20 counties of the State have been freed from ticks and this is held as indicating what can be accomplished in all sections where stock laws prevail. The price paid for cattle below the quarantine line is from ¼ to ½ ct. per pound less than for cattle of the same quality above the line and this alone would mean a loss of $50,000 annually in the area which has been freed from ticks. This amount is about three times the total cost of the work of eradicating ticks in these counties during the entire 5 years. For the most part the ticks have been eradicated by the use of the starvation method.

Malignant catarrhal fever of cattle, E. DIEM (*Wchnschr. Tierheilk. u. Viehzucht, 50* (*1906*), *No. 42, pp. 826, 827*).—This disease has been almost unknown in the region of Burghausen for the past nine years, but occurred to a limited extent during the present season. The author treated 3 animals by injecting 1.5 liters of physiological salt solution subcutaneously for 3 days in succession. The treatment was without result. In this case it was believed that infection came through the ground water, and a suitable system of drainage was, therefore, recommended.

An unusual case of chronic tympanites in cattle, H. HOLTERBACH (*Berlin. Tierärztl. Wchnschr., 1906, No. 37, pp. 679–681*).—The usual symptoms of tympanites are described with particular reference to a chronic case which came under the author's observation. In this case the abdomen of the cow became considerably distended with gas after each feed. Remedial treatment was of no avail and the animal was slaughtered. An examination of the intestines showed that the duodenum was firmly attached to the liver, at which point the lumen was very small. The intestine also made a sharp turn almost at right angles at about the same level.

Pathogenesis and treatment of railroad disease of cattle, J. SCHMIDT (*Berlin. Tierärztl. Wchnschr., 1906, No. 43, pp. 775–779*).—According to the observations reported in this article, railroad disease attacks chiefly pregnant cows which have been maintained on pastures until the time of shipment. The symptoms include fever, loss of appetite, and cerebral anemia.

The author concludes that railroad disease of cattle should be described as an anemia of the cerebral nervous system and disturbances of the vasomotor nerves as a result of transportation in cars. No suitable preventive treatment has been devised, but cases which have developed may be treated with much success by pumping air into the udder in the same manner as recommended for treatment of milk fever.

An investigation in the County of Wexford of a disease in young cattle, J. H. NORRIS (*Dept. Agr. and Tech. Instr. Ireland Jour., 7* (*1906*), *No. 1, pp. 17–25, pls. 8*).—Earlier investigations along this same line have already been noted (E. S. R., 16, p. 1027). The author has confirmed his previous view that the presence of *Strongylus gracilis* in the stomach of young cattle may cause a serious wasting disease and death if no attention is given to the animals.

Medical treatment of the disease appears to be of little value, but the trouble may best be prevented by providing small clean pastures, in which the calves may be maintained for the first year.

Diseases of the stomach in cattle, A. EBER (*Ztschr. Tiermed., 10* (*1906*), *Nos. 5, pp. 321–355; 6, pp. 401–427*).—The author presents in a succinct form a

monographic account of the various diseases which may affect the stomachs of cattle.

Gid of cattle, E. Diem (*Wchnschr. Tierheilk. u. Viehzucht, 50 (1906), Nos. 45, pp. 881–887; 46, pp. 903–906*).—The symptoms of gid in cattle are described with particular reference to its early diagnosis and operation. The author maintains that in nearly all cases where the value of the animal is considerable it is well worth while to remove the bladder worm from the surface of the brain, especially since the operation is comparatively simple and the animal recovers within a few days.

Milk fever and treatment with air infiltration, Albrecht (*Wchnschr. Tierheilk. u. Viehzucht, 50 (1906), No. 38, pp. 741–747*).—The literature relating to this disease was briefly reviewed with particular reference to the condition of the udder observed in cases of milk fever. In a case reported at some length by the author the udder remained unusually flabby during the last 3 weeks before parturition and was not greatly distended after parturition. The symptoms of milk fever which developed were relieved by the infiltration of air and a prompt recovery took place.

Cystitis and its treatment, Gmeiner (*Monatsh. Prakt. Tierheilk., 18 (1906), No. 1–2, pp. 61–79*).—The usual forms of cystitis in domestic animals are described and clinical notes are given on a number of cases.

During the author's experiments with remedies it was found that mercuric oxycyanid in the proportion of 1:5,000 to 10,000 in water, with the addition of salt, constitutes the most satisfactory antiseptic for relieving the inflammatory conditions and bringing about a cure of all ordinary cases of cystitis. Among the medicines suitable for internal use the best results were obtained from urotropin in doses of $\frac{1}{2}$ to 1 gm. three times daily for small animals and 5 to 10 gm. for larger animals. Both of these lines of treatment may be combined with excellent results.

Septicemia of swine, J. Pekar (*Tierärztl. Zentbl., 29 (1906), No. 31, pp. 489–491*).—The controversy regarding the development of septicemia or swine erysipelas as a result of vaccination for the latter disease makes it necessary to examine carefully into the cause of death in cases where claims for indemnity are made. In most cases claimed to be swine erysipelas as a result of vaccination, the disease was believed by the author to be septicemia and disinfection measures are recommended for preventing this trouble.

Lesions of chronic swine erysipelas, S. Eisenmann (*Jour. Méd. Vét. et Zootech., 57 (1906), pp. 530–538, 577–588, figs. 5*).—Brief descriptions are furnished of the lesions which arise in chronic cases of swine erysipelas in the joints, liver, stomach, intestines, and skin. The great differences observed in the effectiveness of vaccination in different hogs are ascribed to variations in the strength of the vaccine used, the extreme susceptibility of some hogs to the disease, and variations in the length of time during which the vaccinated hogs are kept under observation.

Pathological changes in the crystallin lens in various forms of cataract in horses, F. Mette (*Monatsh. Prakt. Tierheilk., 18 (1906), No. 3–4, pp. 97–133, pls. 4*).—The literature relating to cataracts in horses is carefully reviewed in connection with a short bibliography.

The histological pathology of different forms of cataracts is described in detail. It appears that in general the anatomical changes cause a cloudiness of the capsule of the lens, the substance of the lens, or both. The pathological changes may consist in a deposition of coloring matter in the interior part of the capsule, in the formation of fibrous tissue on the inner surface of the capsule, or in the proliferation of the epithelium of the inner surface of the lens.

Recurrent mange in horses, T. B. GOODALL (*Vet. Rec., 19 (1906), No. 955, pp. 251, 252*).—The author has noted a number of cases of this disease in which the symptoms were quiescent during the cold months but reappeared in the spring and summer for 3 years in succession. It has been observed that chicken mites will live for a year or more in close confinement without any food being given them. In such cases the mites found alive at the end of the period must have maintained themselves by cannibalism. The same may be true for the mites of horse mange.

Horse sickness, L. E. W. BEVAN (*Rhodesian Agr. Jour., 4 (1906), No. 1, pp. 46–51, pl. 1*).—The symptoms of this disease are described in detail. A system of vaccination has been devised which protects horses quite successfully. On an average somewhat less than 4 per cent of vaccinated animals die. There is little hope of good results from the use of any medicinal treatment of horse sickness.

The distribution of equine piroplasmosis in Italy, L. BARUCHELLO and A. PRICOLO (*Clin. Vet. [Milan], 29 (1906), No. 42, pp. 1009–1015*).—This disease, which also passes under the name of typhoid fever or typhoid influenza, occurs quite generally throughout Italy. Notes are given on the symptoms and pathological processes which accompany the disease.

The use of mercury in the treatment of equine piroplasmosis, G. BARONI (*Clin. Vet. [Milan], 29 (1906), Nos. 43, pp. 1033–1046; 44, pp. 1057–1066*).—Repeated experiments were made in testing bichlorid and biniodid of mercury in intravenous inoculation for the treatment of equine piroplasmosis. The results obtained were quite promising, but the author does not feel justified in recommending this treatment as certain to give desirable results.

Piroplasmosis in dogs, J. WETZL (*Ztschr. Tiermed., 10 (1906), No. 5, pp. 369–379, figs. 3*).—*Piroplasma canis*, which has frequently been demonstrated in dogs, closely resembles the blood parasite of Texas fever in cattle. The morphology and biology of this parasite is described and notes are given on symptoms in cases of piroplasmosis in dogs. Inoculation of healthy dogs with the blood of affected animals readily produces infection.

Rabies and the capture of stray dogs, H. MARTEL (*Rev. Vét. [Toulouse], 31 (1906), No. 11, pp. 710–720*).—Statistical data are presented regarding the extent of rabies in parts of France as related to the number of stray dogs. The results of an organized crusade against stray dogs are very striking. Since 1885 the total number of dogs in Paris has greatly increased, while the percentage of rabies among dogs has fallen rapidly. The author argues, therefore, for the great advantage of the destruction of all stray dogs.

Rabies in rats and field mice, B. GALLI-VALERIO (*Centbl. Bakt. [etc.], 1. Abt., Orig., 42 (1906), Nos. 3, pp. 203–208; 4, pp. 297–303, fig. 1*).—In a study of rabies in rats and field mice it appears that Negri's bodies are exceedingly rare and small as compared with the same structures in dogs and most other animals susceptible to rabies. The attenuated virus obtained from the medulla oblongata of infected rats and mice did not always have the power of protecting other rats and mice against the disease.

Nagana in poultry, O. GOEBEL (*Compt. Rend. Soc. Biol. [Paris], 61 (1906), No. 30, pp. 321–323*).—Poultry are considered by most investigators to be immune to nagana. The author found, however, that fowls inoculated with nagana virus obtained from guinea pigs retained the virulent blood in the body for a period of nearly 2 months. When removed the virus was found to have retained its virulence and to be fatal for guinea pigs.

Filaria clava in the domestic pigeon, L. G. NEUMANN (*Rev. Vét. [Toulouse], 31 (1906), No. 10, pp. 661–664, figs. 2*).—This parasitic worm was first described

as occurring in pigeons in 1856. The author has made a study of the anatomy and biology of the pest, which are described in the present article. The parasite is found most commonly in the connective or subcutaneous tissue about the trachea and elsewhere in the region of the neck.

RURAL ENGINEERING.

Can the yield of crops be increased by irrigation under the climatic conditions of Germany? Gerlach (*Mitt. Deut. Landw. Gesell., 21 (1906), No. 49, pp. 384–386*).—The writer takes up this question in a general way, giving some results already found and suggesting lines along which research should continue to determine if irrigation is practicable and profitable in Germany. German experiments are quoted which give the absolute water requirements of different crops per pound of dry substance, as follows: Wheat, 338 lbs. of water; rye, 353 lbs.; oats, 376 lbs.; barley, 310 lbs.; peas, 273 lbs.; red clover, 310 lbs.

From experiments with and without fertilizers, it is concluded that irrigation is of little value in increasing the yield when there is a deficiency in plant-food material. Thus, without fertilizers, 1,665 lbs. and 3,330 lbs. of water resulted in an increase in yield of 1.48 lbs. and 1.59 lbs. of dry substance, respectively; and with fertilizers, 2.89 lbs. and 7.9 lbs., respectively.

The rainfall necessary to produce a normal development of field crops in Germany is given as follows: Winter grain, 23.6 in. per year; barley, 20.8 in. per year; oats, 25.2 in. per year; potatoes and beets, 23.6 in. per year.

A table is also given showing the ideal distribution of rainfall through the year by months. The results are not applicable for all parts of Germany, since for Pentkowo in 1903–4 the following crops were grown with only 15.65 in. of rainfall: Rye, 3,740 lbs. per acre; wheat, 4,460 lbs. per acre; oats, 3,740 lbs. per acre.

With regard to the most successful way of retaining soil moisture, the author states that it is doubtful if much can be added to the present knowledge of the effects of cultivation and tillage. He thinks, however, that in case of drained lands the common German practice is to drain too thoroughly, particularly in spring and summer, in localities having but little precipitation during these seasons.

On automatic puddling of channels, [H. Marsh] ([*Proc.*] *Irrig. Conf., Simla, 1904, I, pp. 130–133, figs. 4*).—The necessity is stated of providing some means of lessening the 50 to 60 per cent loss in water between the canal head and the fields. Lining the channels by manual labor is not considered practicable, since it is estimated that the lining of a 3-ft. lateral would cost about $2,500 per mile and would lead to a return of only $75 per mile. In the writer's opinion the only practicable method is the puddling of the perimeter of the channel by the running water. This he effects by giving the main canals a slope of about 0.5 or 0.6 ft. per mile. Deposition of silt in distributaries is said to be due more to excessive erosion in the main canals than lack of velocity in the distributaries.

Instances of the success attendant upon reduction of canal slope are given. In one case on the Ganges canal the breaking up of a rapid slope probably is responsible for a saving of 19 cu. ft. per second out of a total of 42 cu. ft., the net outcome being that an expense of about $10,500 produced a capitalized economy of water amounting to $190,000. In another instance a channel with a gravelly bed experienced a loss of 27 per cent in the discharge when water was first turned in. The percolation thereafter diminished to 1.8 per cent, due to gradual silting up.

The artesian wells of Australia, P. PRIVAT-DESCHANEL (*Génie Civil, 49 (1906), No. 20, pp. 309–312, figs. 5*).—A study of the peculiar conditions which in Australia have favored the extensive use of artesian wells. Sections are given showing the geological formation, which is a typical half basin, with the infiltration zone on the west slope of the dividing range on the east coast, and with a continuous flow toward the Gulf of Carpentaria. At the present time Queensland possesses 960 wells, public and private, of which 628 are flowing. Their total depth is 357 km., and total daily flow is 1,750,192 cubic meters. In New South Wales the total daily discharge is 631,744 cubic meters. With those of Queensland, they furnish the enormous total of 2,831,933 cubic meters per day.

The legislation on the subject is unique. The government upon petition and after investigation of the practicability of the scheme will drill wells in any locality, the expenses being met by special tax upon the proprietors benefited. The tools, superintendence, and transportation of supplies are furnished by the government. Although the latter exercises no supervision over private wells, a special system has been devised whereby the State leases very large tracts at a modest rental, $4 to $10 per hectare, for a period of 24 years, with privilege of indefinite renewal, upon condition that the lessee bore artesian wells, from which he is to profit during the term of lease but which become the property of the State after abandonment.

Artesian water is applied in Australia to three purposes, briefly: (1) The establishment of public watering places on the long overland trails; (2) cultivation by irrigation, patterned after California methods, fruit being extensively grown on blocks of 15 to 20 acres surrounding artesian wells and to which the government rents a certain quantity of water at a profitable price; and (3) stock raising.

In spite of the number of wells the level is not appreciably lowered, even in periods of exceptional drouth, and the prospects of this water supply when so developed as to make possible the settlement of central Australia are considered very good.

The wind engine for pumping, G. PHELPS (*Surveyor, 30 (1906), No. 779, pp. 702, 703*).—In a paper read before the Association of Water Engineers in London the writer discusses the modern windmill in connection with its use in the pumping of water for the supply of small rural communities.

The cost of oil and attendance for such mills is figured at from $25 to $30 per year, but it is considered necessary, in order to secure a constant supply, that reservoir capacity be provided, as well as auxiliary machinery, which in some cases may be a horse gear arranged to be coupled to the pump during long-continued periods of calm. A table is given showing an approximate average duty of wind-pumping engines, with an assumed lift of 100 ft., including friction, from which the following figures are taken:

Average duty of wind-pumping engines.

Diameter of wheel in feet.	Revolutions of wheel per minute in a 15-mile wind.	Water raised per day in gallons. 100-foot lift.
10	48	1,200
12	40	2,000
14	34	3,500
16	30	6,500
20	24	16,000
40	12	80,000

These figures are given as the result of actual experience and in the opinion of the writer may be relied upon, assuming the site to be reasonably good and

the pump proportioned to the work. The calculations for total quantities raised are based on an assumed average of at least 8 hours per day, with a wind sufficiently strong to work the mill at average speed, which in practice is found to be a safe assumption.

With regard to wind velocity it is stated that intermittent working only can be expected with velocities of 5 to 10 miles per hour. With velocities of 10 to 15 miles per hour steady working at about average speed should be obtained.

A typical example of a village supply pumped by wind power is given, from which the following particulars are abstracted: Wind wheel 18 ft. diameter, with hinged canvas sails, working a single-acting, deep-well pump $1\frac{1}{2}$ in. diameter and 8-in. stroke, well 55 ft. deep; total lift from water level to reservoir 130 ft., exclusive of friction. Reservoir capacity 30,000 gal., equivalent to 6 days' supply for a population of 400 people. Auxiliary machinery consists of a triplex pump, worked by horsepower. The cost of pumping was found to be less than $15 per annum. Cost of windmill, horse gear, pumps, and well fittings, $1,725, and total cost of whole scheme, $11,000; cost of attendance, $25 per annum.

The trials of suction gas plants at Derby, 1906 (*Engineer (London), 102 (1906), Nos. 2659, pp. 608–611; 2660, pp. 625, 626*).—The Royal Agricultural Society conducted a number of tests of suction gas plants in June, 1906, at the annual show at Derby, England. The declared object of these tests was to determine as well as possible in the short time allowed whether suction gas plants would work as reliably under agricultural conditions as the steam engine and with as small an amount of attendance as the oil engine. A satisfactory answer to these questions would prove the suitability of such plants for agricultural purposes, since their advantages from the standpoint of economy are accepted without question. The deciding factor in judging the merits of the different plants tested was their simplicity, since it was expected that the plants in many cases would be placed in charge of farm hands who would be unable to make adjustments which lead to small economies in working.

The regulations surrounding the tests were fairly stringent, it being intended to duplicate, as nearly as possible, the running conditions of actual practice. The plants tested were limited to sizes ranging at and below 20 horsepower, and a variation of not more than 5 per cent from the declared horsepower was allowed. The engines were run for 9 consecutive hours under constant load, when they were shut down for the night, to resume running next day. Special attention was paid to the following points: (1) Attendance necessary; (2) general design, including facility of cleaning and space occupied; (3) regularity of work; (4) fuel consumption and water consumption; (5) price; (6) relative proportions of gas producer and engine; (7) volume swept by piston relative to brake horsepower.

The results of observations upon several of these points are briefly given, as follows:

1. It was found that, without considering the additional help in turning over the engine at starting, one attendant only was required, and his time could largely be spent in other duties. Although less manual labor is required than in the case of the steam engine very intelligent care is necessary, however, to produce gas of good quality.

3. Although regularity of working, so far as the engine was concerned, was found to be dependent upon the amount of tar present in the gas, the gas producer itself is evidently the portion of the plant requiring most attention, since the gas is made as required and consequently difficulty is experienced in responding quickly to changes from light to full load.

4. In testing the fuel consumption the fact was kept in mind that it is important to know not only the amount consumed during the run, but also the amount consumed during the night when the fire was banked. It was concluded that where coke could be obtained it would be a more desirable fuel than anthracite coal, even when not considering the greater tendency of the latter to produce tar. In the 11 plants tested the consumption per brake horsepower at full load varied between 1.04 and 1.48 lbs.; at half load between 1.38 and 1.98 lbs.; and at full load with coke between 1.21 and 1.65 lbs., while the difference between the best and the worst plants at full load was less than ½ lb. of coal. The difference among the better plants was almost insignificant, amounting to no more than 0.04 lb. Questions of economy can, therefore, be left out of account in deciding upon the make of plant to use, the decisive factor being cost per brake horsepower. This varied in the tests given between $44 and $85, the winners of the awards both pricing their plants at about $56 per brake horsepower.

An interesting fact developed at the trials was that as much water was required for the operation of these plants as would be necessary for a steam engine plant. Various tables are presented, giving details of the test, such as compression, explosion, and suction pressures, and other data, making the report one of unusual interest and value.

Additional information on the durability of wooden stave pipe, A. L. Adams (*Engin. News, 56 (1906), No. 15, p. 378, fig. 1*).—A wooden stave pipe at Astoria, which is buried in the earth and is under constant water pressure, has proven deficient in durability, contrary to preconceived ideas as to the behavior of wood under such conditions. The pipe in question deteriorated so much in ten years that extensive renewals and repairs became necessary during 1905. The facts made prominent from the experience with this pipe are as follows:

"(1) Staves, which are constantly subject to water pressure from within and are buried in the ground, may be very short-lived.

"(2) The magnitude of the water pressure, beyond a moderate head, has had little or no influence in preserving the timber.

"(3) The pipe laid above ground has not deteriorated to any considerable extent, nor has the pipe laid in the tunnels leading from the distributing reservoir.

"(5) When the depth of backfill has exceeded 2 ft. above the pipe, and the material has been free from vegetable matter, and has been of a fine and impervious character, much less deterioration has taken place.

"(7) Decayed staves have been found all around the pipe.

"(8) Sound staves have been frequently found contiguous to badly decayed staves.

"(10) The bruising of the staves during the process of erection seems to have been one of the chief agencies in hastening decay.

"(11) Decay has been confined to the outside of the pipe.

"(13) The malleable cast band fastenings have been found to be in good condition."

Economics of road construction, H. P. Gillette (*New York: The Engineering News Pub. Co., 1906, 2. ed., pp. 49, figs. 9*).—In this work the author undertakes to point out certain defects in current road engineering practice and to correct certain common errors in estimates and specifications. He advises designing the cross section of the road in such a way that modern excavating and grading tools can be used in construction. It is claimed that deep side ditches are unnecessary, since the heaving action of frost is said not to affect materially a macadam road with a foot of dry soil beneath it. In view of the

fact that the tractive power of a team may be as great as 1,000 lbs. for a short time, grades as heavy as 7 per cent are said to be allowable, thus frequently avoiding the necessity of constructing deep cuts.

A new theory is advanced as to the cause of the binding which takes place when a broken stone road is rolled and sprinkled, it being claimed that the surface tension of water in the capillary voids of the screenings is the true binding agent, from which it is argued that there should be considerable fine dust in the binder. Certain economies in the construction of macadam roads are pointed out, and the laws under which roads are built are briefly discussed.

Corn-harvesting machinery, C. J. Zintheo (*U. S. Dept. Agr., Office Expt. Stas. Bul. 173, pp. 48, pls. 4, figs. 24*).—In this bulletin the author reviews the history of corn-harvesting machinery, tracing the development of the present types of machinery from the earliest inventions and appliances and discussing the various methods of harvesting corn in use at present.

The several machines for cutting and shocking corn are described and data are given as to their draft, cost, and operating expenses. Some of the objections and advantages of the corn pickers which have been invented from time to time are briefly touched upon. Cutting and shredding machines and huskers and shredders are described and their operation from the standpoint of safety of the operator is gone into with some detail. Following this the author takes up the economics of corn-harvesting problem, and gives data on the cost of harvesting by hand and machines, the cost of filling silos, and of shredding and preparing fodder.

In conclusion, the author states that "the best way to preserve the greatest quantity of food materials of the original corn fodder for feeding of farm animals is by means of the corn harvester, ensilage cutter, and the silo. The cost of placing 1 acre of corn in the silo is about the same as that of an acre of cured fodder. . . .

"By the use of the proper machinery for harvesting the corn crop, the farmer may increase the net income from his crop $8.72 per acre over hand methods of harvesting the ears and wasting the stalks and still allow full price for the use of the different machines."

Cost notes on a reinforced-concrete silo (*Engin. Rec., 54 (1906), No. 22, p. 607, figs. 2*).—A cylindrical-shaped silo recently built at McLean, Ill., has the following dimensions: Height, including footing, 28 ft.; inside diameter, 22 ft. 3 in.; thickness of wall, 6 in.; footings extend 2 ft. below ground level and are 9 in. thick; total quantity of concrete 38.2 cu. yds.

The silo was built up by the aid of forms consisting of 2 concentric rows of T-shaped posts held erect by guys, each row supporting two thicknesses of weatherboarding, which in turn formed the backing of the curbing. The latter consisted of 2 in. by 8 in. sticks 4 ft. long, supported vertically and which were removed after the completion of each successive section of the work by loosening the rings from the posts, the rings then being moved up to the next section, the curbing replaced, and more concrete filled in. The work progressed at the rate of 4 ft. vertically per day, the forms being filled in the afternoon and moved up the following forenoon. The work was done by farm laborers hired by the month and required 100 man-days of such labor. A mason spent 7 days at $3.50 per day brushing and troweling the surface. The concrete used was in the proportion of one of cement to six of sandy gravel, the former costing $100, the latter $35. The reinforcing consisted of ten iron hoops ($2\frac{1}{2}$ by $\frac{3}{16}$ in.) equally spaced in the lower half of the structure. In the upper half 1 ring of 4 ft. woven wire fencing was placed in each section. The total cost of reinforcing was $5.20, which does not include the hoops, or the new lumber

necessary (weatherboards), which cost $18. With farm labor at $1.75 per day, the total cost of the silo, not including old material made use of, was $360 or $9.42 per cu. yd.

RURAL ECONOMICS.

The relations of rents, wages, and profits in agriculture, and their bearing on rural depopulation, J. S. NICHOLSON (*London: Swan, Sonnenschein & Co., 1906, pp. 176; rev. in Jour. Roy. Statis. Soc., 69 (1906), No. 4, pp. 763–765*).—This is a series of lectures delivered at Cambridge University on the history and economics of agriculture.

The history of agriculture is traced from the mediaeval period to the present time, and the economics of agricultural rent, wages, and profits are compared. As a result of these studies the author maintains that modern rents in money terms are not as onerous as when tenant-farmers paid rent in labor and in produce; that a steady augmentation has occurred in the price of farm labor, while otherwise the agricultural industry is depressed; and that there has been no wholesale depopulation of the rural districts of England. "The relative increase of the urban population is shown to be world-wide and due to far-reaching economic causes, and not to any peculiarities of land tenure or systems of cultivation or property."

The return to the land, J. MÉLINE (*London: Chapman & Hall, 1906; rev. in Jour. Roy. Statis. Soc., 69 (1906), No. 4, pp. 765–768*).—This is a description of the relations of industry and agriculture in France, with a plea for the promotion and improvement of agriculture as a relief from the overcrowding of French cities and the internecine struggle of nations for industrial supremacy.

To encourage the repopulation of rural districts, the author suggests among other means greater facilities in securing agricultural credit, a larger extension of cooperative methods, governmental relief from oppressive taxation on agricultural lands, better rural education, the enactment of a homestead law, and other measures.

Report of the Agricultural Organization Society for the 18 months ended June 30, 1906, R. A. YERBURGH and J. N. HARRIS (*Rpt. Agr. Organ. Soc. [London], 1906, pp. 127, figs. 12, map 1*).—This report reviews the progress of the agricultural cooperative movement in England and Wales from its origin in April, 1901, to June, 1906, and gives a review of the work of the Agricultural Organization Society for the 18 months ended June 30, 1906.

The organization had at the latter date 154 affiliated societies in 41 counties, and at the close of the year 1905 reported 7,439 members and a business of £221,524 for that year.

The work of the societies embraces the purchase of agricultural supplies, cooperative ownership of machinery, cooperative sale of produce, experiment plats, improvement of live stock, agricultural credit, motor service, and the regulation of the tenure of allotments and small holdings. Every branch of the work was prosperous and of great advantage to farmers, but the committee believes that "if the A. O. S. had larger funds the development of agricultural cooperation in England and Wales would proceed with far greater rapidity than at present." To overcome this difficulty a central cooperative agricultural bank has recently been organized and registered, the sole purpose of which is to advance money to local credit societies which "will be able to play to the full their function of collecting the savings of country districts and returning them in the form of the much-needed capital for the exploitation of the land."

Agricultural cooperative societies [in Brazil], C. BORGES, Jr. (*Bol. Dir. Agr. Bahia, 8 (1906), No. 5, pp. 460–467*).—The author points out in this article the

advantages that have resulted to farmers in European countries through cooperative and credit societies, shows the difficulties in the way of agricultural organization in Brazil, and urges upon the government the advisability of improving rural educational conditions. The establishment of research stations and cooperative societies he maintains would be of great advantage to the agricultural class and to the economic welfare of the country at large.

The use and objects of agricultural societies, E. B. DENHAM (*Trop. Agr. and Mag. Ceylon Agr. Soc., 27 (1906), No. 6, pp. 500–503*).—The author discusses the origin, development, and aims of the Ceylon Agricultural Society.

This society was founded in November, 1904, and at the close of 1906 had 1,120 members and 45 branches with a membership of about 3,500. Besides publishing leaflets from time to time on agricultural topics in the Singhalese, Tamil, and English languages, the society has selected the *Tropical Agriculturist* as its official organ. This publication is issued in English and Singhalese, and is sent free to members of the society.

Among the aims of the society are the introduction of new varieties of paddy from India and Japan, the introduction of new products, the encouragement of cotton cultivation, and the distribution of vegetable seeds. "The use of the branch societies as cooperative centers for experiments and for the adoption of the cooperative credit system is another side of the society's work." In general, the main purpose of the society and its branches is to accumulate and disseminate among Singhalese farmers the most advanced and practical information on all phases of agriculture.

The "Dông-Loï" native cooperative societies in Tonkin, C. PRÊTRE (*Bul. Écon. Indo-Chine, n. ser., 9 (1906), No. 58, pp. 1025–1057*).—This is a report by the civil-service administrator to the governor-general of French Indo-China regarding the progress of the cooperative agricultural societies of Assam during the 4 years of their existence, with suggestions as to the best means of promoting the welfare of the native farmers through cooperative societies.

It is shown that the native farmers have been for years at the mercy of unscrupulous money lenders, who charge high rates of interest, and the societies were organized for the purpose of enabling the members to buy seed rice and other agricultural necessities at reasonable rates and to sell their products at better advantage. For the future development of these societies it is recommended that the government encourage the establishment of district cooperative banks, as has been done in France, for the purpose of accumulating the savings of the peasants and of purchasing and supplying seed rice to the members at an amount equal to the value of their deposits, and also for the establishment of a rice granary under government control to provide seed and food to the natives at reasonable prices in times of scarcity or famine.

A series of appendixes give the by-laws of representative societies, a statement of accounts showing their financial condition on December 31, 1905, and a table showing the quantity and value of paddy sold to the society by producers in the province of Kiên-an in 1905 and 1906.

Crop Reporter (*U. S. Dept. Agr., Bur. Statis. Crop Reporter, 9 (1907), Nos. 1, pp. 1–8; 2, pp. 9–16*).—These numbers for January and February, 1907, contain, in addition to the usual statistics on the yields and condition of crops in the United States and foreign countries, special articles on: Tobacco crop by types—average price; exports of wheat, July to November, 1906; stocks of American cheese, December 31; high price of India jute; number and value of farm animals, January 1, 1907; colonial cotton production; the 1906–7 wheat and flaxseed crops of Argentina; foreign trade in farm and forest products, 1905 and 1906; and other agricultural topics.

Comparison of English and foreign agriculture (*Jour. Roy. Statis. Soc., 69 (1906), No. 4, pp. 746–751*).—In this article attention is called to certain leading contrasts in the agriculture of typical European countries.

Statistics are presented and discussed which show the acreage in cereals, potatoes, root crops, and fallow per 1,000 acres in 8 countries of Europe, and a comparison is drawn between the agricultural position of Germany and Great Britain. From statistics on the wheat areas, it would seem that there are 110,000,000 acres of this cereal under cultivation in Europe, "of which much more than half is to be found in Russia, Hungary, and the Danubian states." Russia, Poland, and Germany together have 83 per cent of the rye crop.

Data are also compared as to the number of cattle and sheep in 13 European countries. Belgium leads in the number of cattle and the United Kingdom in sheep, with 245 and 374 per 1,000 acres of land, respectively.

Agricultural statistics and chattel mortgages, N. MONTEITH (*Ann. Rpt. Bur. Indus. Ontario, 1905, pp. 48*).—In addition to meteorological phenomena for 1905, this report gives in part 1 detailed statistical data of the acreage, yields, and market value of the staple field crops grown in each county of Ontario in 1905, together with the totals for the province for the past 10 years and the average for the 14 years 1892–1905.

From bulletins issued by the Ontario department of agriculture abstracts are given on the season and crops for the year, live stock and dairying, labor and wages, etc. A scarcity of farm labor prevails, notwithstanding the presence of fresh immigrants from Great Britain. "Farmers are utilizing improved machinery and newer methods more and more in order to get along with less manual aid. Skilled farm laborers receive from $30 to $40 a month, and from $1.50 to $2 a day, during harvesting, but inexperienced men get as low as half these wages."

Part 2 consists of tabulated data regarding chattel mortgages in the province for the years 1896 to 1905, inclusive. The prosperity of the farmers in the province is shown by the reduction of the number of mortgages from 11,638 in 1896 to 7,403 in 1905, securing indebtedness of $3,826,582 and $2,758,046, respectively.

Agricultural statistics of Ireland, with detailed report for the year 1905 (*Dept. Agr. and Tech. Instr. Ireland, Agr. Statis. 1905, pp. 166*).—This report contains statistics on the acreage under crops, crop production, number of land holdings in each county and province, live stock, dairy industry, bee keeping, milling industry, forestry, wages of laborers, and other matters relating to agriculture in Ireland.

Agricultural statistics, Ireland, 1906 (*Dept. Agr. and Tech. Instr. Ireland, Agr. Statis. 1906, pp. 23*).—Data are presented regarding the acreage under crops and the number and kind of live stock in each county and province of Ireland for the years 1905 and 1906.

Agricultural statistics of India for the years 1900–1901 to 1904–5 (*Agr. Statis. India, 21 (1904–5), I, pp. 420; II, pp. 90*).—This publication gives detailed data of British India and native States relating to area of all provinces, forest lands, and cultivable and uncultivable lands; crops irrigated and sources and extent of water used in irrigation; area under crops and yields of crops; number of live stock and implements; land revenue of the provinces; transfers of lands; tea and coffee production; and other agricultural statistics.

The basis of rural industry and bookkeeping, J. B. LAMBL, trans. by G. EDANGE (*La Substance de la Propriété Rurale et la Comptabilité Agricole. Paris: Librairie des Sciences Agricoles, 1906, pp. 32*).—The author points out in this pamphlet that the constituents of air and soil, which largely enter into the composition of plants and animals, are to a great extent gratuitously supplied

by nature, and that on this account the cost of production of agricultural products can not be definitely determined. He maintains, therefore, that the double-entry system of bookkeeping employed in industrial pursuits, where all economic factors which enter into the cost of manufactured articles are definitely known, is not suitable for keeping agricultural accounts.

Bookkeeping for farmers, T. C. ATKESON, edited by H. MYRICK (*New York: Orange Judd Co., 1905, pp. 40*).—In this volume a comprehensive system of keeping accounts by Professor Atkeson is supplemented by a practical outline of the Stockbridge system. The two methods are believed to offer to the farmer a system of bookkeeping that will enable him to know at any time "how the business of the whole farm, or any part of it, stands."

AGRICULTURAL EDUCATION.

The education of the farmer, D. KINLEY (*Ill. Agr., 11 (1906), No. 3, pp. 61–66*).—In this paper the dean of the graduate school of the University of Illinois discusses the education of the farmer from the three considerations of success, happiness, and highest social service. In order to be successful it is important that he shall be trained along the technical lines now receiving attention in the agricultural colleges and also in the commercial side of farming—the education which treats of farming as a business and is concerned with the principles of prices, market organizations, transportation routes and rates, competitive sources of supply, farm organization, and similar subjects. To this end he should study among other things economics and industrial history.

The farmer should also be taught the cultural studies—history, literature, language, mathematics, and the like "for the training and the pleasure and the recreation that they bring," and he should be educated for citizenship in order to have an intelligent comprehension of matters of public policy, such as the tariff, the trusts, railroad rates, and the banking problem. Knowledge and right thinking along these lines come largely with the study of history, home economics, and political economy.

The writer recognizes the possibility of educating away from the farm, but thinks that this will be only a temporary effect, that gradually, as more educated men take up farming and social life in the country becomes more agreeable to educated men, there will be less tendency to leave the country on account of the intellectual and social attractions of the city.

The education of the farm boy, G. L. BISHOP (*Bien. Rpt. Okla. Bd. Agr., 2 (1905–6), pp. 285–290, fig. 1*).—An argument for an agricultural education for all farm boys, in which the ways of getting such an education are pointed out and attention is called to its advantages.

Agriculture in public schools, A. M. SOULE (*V. P. I. Agr. Jour., 1 (1906), No. 1, pp. 17–19*).—A plea for nature study in the smaller public schools, agricultural subjects in consolidated rural schools, and regular courses in elementary agriculture and the sciences pertaining thereto in all high schools. The writer considers that the main difficulty in carrying out such a program is not inability on the part of teachers to teach agriculture, but indifference toward the subject. He favors the development of suitable courses in agriculture in the secondary schools of the State rather than the establishment of separate agricultural schools.

Agricultural education, A. C. SCOTT (*Bien. Rpt. Okla. Bd. Agr., 2 (1905–6), pp. 261–271*).—An address before the Oklahoma Board of Agriculture comprising a discussion of (1) the education of the man who stays on the farm—elementary agriculture in all public schools, college short courses, the agricultural papers, experiment station bulletins and other literature, and (2) "the

education he could aspire to as a man and a citizen"—the full college course with not only the technical training it implies, but also the culture and refinement that comes from higher training in history, literature, and other subjects of study.

Agriculture in the public schools of Oklahoma, E. E. BALCOMB (*Bien. Rpt. Okla. Bd. Agr., 2 (1905-6), pp. 276-279*).—An address before the Oklahoma Board of Agriculture in which the speaker argued for agriculture in all public schools, not to teach the science or the art of agriculture, but the underlying principles of plant and animal breeding, cultivation of crops, selection of seed, etc., by means of the text-book and practical experiments.

How agriculture is taught in the schools of other lands, and how it may best be introduced into the schools of Texas, A. C. ELLIS (*Texas School Jour., 24 (1906), No. 3, pp. 24-33*).—This is an address delivered October 20, 1906, before the Texas Industrial Educational Convention by the Associate Professor of Education in the University of Texas.

Agricultural education is defined and a course based on the syllabus given in Circular 60 of this Office is outlined and amplified. It is shown that there is a very definite and useful body of knowledge concerning some of the important phases of agriculture, that this can be taught in public schools, and that it ought to be taught not only because of the information given, but also on account of the training given to the mind and body of the pupils.

As regards the programme with reference to this work in Texas schools, it is argued that it would be inadvisable to require the teaching of agriculture in all the one-teacher rural schools. Instead of this it is recommended that (1) all teachers be required to learn something about scientific agriculture and how it is taught, and that the capable and fortunately located teachers be definitely encouraged to introduce agriculture into their schools; (2) the teaching of agriculture be required in rural schools possessing more than one teacher, of which there are about 2,000 in the State, and (3) the 1,000 independent districts in the State be encouraged to introduce agriculture. For the 8,000 one-teacher rural schools in Texas consolidation and more efficient superintendence are recommended.

In order to procure teachers for the work suggested, it is recommended (1) that for the teachers of agriculture in high schools and for the directors and general leaders of this work, the agricultural and mechanical college employ a professor of pedagogy, introduce training courses, and be allowed to grant State life certificates. It is stated that the State university has not the equipment for training these leaders and the normal schools are not doing work of high enough grade. Furthermore, the university and the three normal schools are unable with their present facilities to train all of the teachers needed for the public schools. (2) "For the training of teachers in elementary agriculture there should be established at once short winter and short summer courses especially arranged for teachers." It is thought that in one short session of two months a teacher can get a fair knowledge of what is taught in elementary agriculture, and in two such sessions, with a year of reading and of practice in the school intervening, he may become a really good teacher of the elements of agriculture, such work as is possible in the elementary rural schools having more than one teacher. Such short courses could be given not only at the agricultural and mechanical college, but also at the college of industrial arts, the three normal schools, and, if necessary, at the State university summer school.

Professor Ellis does not believe in the establishment of special high schools to provide secondary instruction in agriculture. He believes such schools have a tendency to create class distinctions, and cites in evidence of this the schools of

Germany and Japan. A large part of a child's education comes from his association with his school companions and with his teachers out of class, and the election of special courses in agriculture is sufficiently narrowing without putting the boy "off in a school in which all the pupils and all the teachers are studying exactly the same subject." In his opinion it would be wiser and more economical to develop a system of agricultural education within the present common school system in harmony with the social organization and social ideals of these schools. He would therefore introduce elective courses in agriculture in the existing high schools of Texas, and provide extra teachers and extra laboratory facilities for this work.

Why agriculture should be taught in the high school, K. L. HATCH (*Wis. Jour. Ed., 39 (1907), No. 2, pp. 73, 74*).—The reasons given by the author are to prepare students to teach the subjects in the common schools, to prepare students for the work of the agricultural college, and to direct attention to life on the farm and its ever increasing possibilities.

Report of committee on extension work (*U. S. Dept. Agr., Office Expt. Stas. Circ. 72, pp. 8*).—This is the first report of the committee on extension work of the Association of American Agricultural Colleges and Experiment Stations. It includes a definition of extension teaching in agriculture as interpreted by the committee, and a grouping of the divisions of this work as follows: (A) Farmers' institutes, (B) itinerant lectures other than farmers' institutes, (C) literature, (D) object lessons or outdoor practicums, (E) rural societies, and (F) other associations. The report also outlines 42 lines of extension work, and makes a number of recommendations with reference to the future work of the committee.

History of farmers' institutes in the United States, J. HAMILTON (*U. S. Dept. Agr., Office Expt. Stas. Bul. 174, pp. 96*).—This bulletin brings together data respecting the origin and progress of the farmers' institute movement in the several States and Territories up to the year 1904, since which time the progress of the institutes has been recorded in the annual reports of the Farmers' Institute Specialist of this Department. It contains historical data concerning Government aid to institutes, the American Association of Farmers' Institute Workers, and institutes in the several States and Territories, the latter prepared largely by the different State directors of farmers' institutes.

Farmers' institutes (*Ohio Sta. Circ. 62, pp. 4*).—A list of officers of the station and the subjects they are prepared to discuss at farmers' institutes.

MISCELLANEOUS.

Report of the Secretary of Agriculture, 1906, JAMES WILSON (*U. S. Dept. Agr., Rpt. 83, pp. 94*).—A general review of the work of the Department of Agriculture during the fiscal year ended June 30, 1906.

Annual Report of Florida Station, 1906 (*Florida Sta. Rpt. 1906, pp. LXIV*).—This includes the organization list of the station, a financial statement for the fiscal year ended June 30, 1906, a general review of the work of the station during the year, statements concerning cooperative work undertaken, reports of different members of the station staff including in some instances the results of observations and experiments, a list of periodicals received by the station, a subject list of station publications, and an article on pineapple culture abstracted elsewhere.

Report of the Experiment Station Committee of the Hawaiian Sugar Planters' Association, 1906 (*Hawaiian Sugar Planters' Sta. Rpt. 1906, pp. 55*).—The general work of the station during the year ended September 30,

1906, is reviewed by the committee in charge and more detailed reports of the officers in charge of the divisions of agriculture and chemistry, entomology, and pathology and physiology are appended. Some of these reports are abstracted elsewhere in this issue.

Eighteenth Annual Report of South Carolina Station, 1905 (*South Carolina Sta. Rpt. 1905, pp. 28*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1905, and reports of the director and heads of departments.

Nineteenth Annual Report of South Carolina Station, 1906 (*South Carolina Sta. Rpt. 1906, pp. 28*).—This includes the organization list, a financial statement for the fiscal year ended June 30, 1906, and reports of the director and heads of the departments reviewing the work of the station during the year.

Interim report of the Canada Experimental Farms, December 1, 1905, to March 31, 1906 (*Canada Expt. Farms Interim Rpt., 1905–6, pp. 98*).—This report, issued primarily on account of a change in the date of closing the fiscal year, summarizes, in a general way, the more important results secured by the experimental farms since their establishment in 1887. Reviews of this nature are submitted by the director, W. Saunders, the agriculturist, J. H. Grisdale, the horticulturist, W. T. Macoun, the chemist, F. T. Shutt, the entomologist and botanist, J. Fletcher, the cerealist, C. E. Saunders, and the poultry manager, A. G. Gilbert. Although the report contains no new work, it is nevertheless of considerable interest, inasmuch as it outlines the progress that has been made in experimental agriculture in Canada during a period of about 19 years.

Experiment Station Work, XXXVIII (*U. S. Dept. Agr., Farmers' Bul. 273, pp. 32, figs. 4*).—This number contains articles on the following subjects: Loss of nitrogen from soils, manure as affected by food, continuous corn culture, pasturing wheat, storage of sweet potatoes, rotting of potatoes in storage, hog cots, the disinfection of stables, the effect of horsetail weeds on horses, treatment of calf scours, preserving eggs, wheat bran, testing individual cows, clean milk, cleanliness in the dairy, grading cream, and paraffin in dairying.

The experiment station building, A. Goss (*Indiana Sta. Circ. 4, pp. 10, figs. 5*).—The condition of the experiment station building is described and illustrated. An appropriation for a new building is being asked for.

NOTES.

Alabama College and Station. In order to relieve the crowded condition at the college, the total enrollment of which has now reached 600 students, the legislature has made an appropriation of $56,500 per year for the next four years to be used exclusively for buildings and equipment. Of this amount $75,000 is to be expended in the erection and equipment of an agricultural building for the joint use of the college and station. In lieu of fees heretofore derived from the analysis of fertilizers, a fixed annual appropriation for maintenance has been made approximating in amount that previously obtained. The veterinarian of the college and station has been made *ex officio* State veterinarian. A live stock sanitary board has been created, with an annual appropriation of $5,000. The greater part of this sum will be used in eradicating the cattle tick, the work being conducted in cooperation with the Bureau of Animal Industry of this Department.

California University and Station.—An appropriation of $132,000 has been made by the State legislature for the equipment of the new farm at Davisville, and the establishment of an agricultural high school on its grounds.

Colorado College.—At the recent session of Congress a quarter section of land was ceded to the college for use in experiments in forestry.

Connecticut College and Stations.—In a special message to the legislature the governor advocated moving the agricultural college at Storrs to a more central and accessible site, and the State experiment station "to the same place, from its present too valuable site in an aristocratic residential section of New Haven, where land values are increasingly high." He asks that the legislature authorize the appointment of a special committee "to consider the problem of unifying, coordinating, and collecting the various agricultural forces of the State's related agrarian establishments and commissions," and recommends that only such appropriations be made for the agricultural college as are necessary to meet fixed charges due to the operation of the college during the next two years, all proposed improvements to await the report of the suggested committee.

A. L. Winton, chief chemist of the State station, has been appointed chief of the Chicago laboratory of the Bureau of Chemistry of this Department, in connection with the administration of the national food law, and has entered upon his duties. J. P. Street, chief chemist of the New Jersey stations, has been appointed to succeed him.

Delaware College and Station.—The State legislature has authorized the issuing of $20,000 worth of State bonds, the proceeds of which are to be used for purchasing and equipping a farm for the use of the college and station. A legislative commission was appointed to purchase the farm and turn it over to the agricultural committee of the board of trustees. This commission has selected a farm of 220 acres, situated about a mile from the college.

At a recent meeting of the board of trustees it was decided to abolish the governing board of the station as at present constituted, and the agricultural committee was given control of all matters pertaining to the station and to the agricultural department of the college. Dr. C. F. Dawson, formerly of the

Bureau of Animal Industry, and more recently of the Florida University and Station, has been elected professor of veterinary science in the college and veterinarian to the station, and C. A. McCue, of the Michigan College, professor of horticulture and horticulturist. Dr. M. T. Cook, recently connected with the station in Cuba, has been appointed botanist of the college and plant pathologist to the station, succeeding F. D. Chester, resigned.

Illinois University and Station.—A laboratory of physiological chemistry has been established in the animal husbandry department of the college of agriculture. Dr. H. S. Grindley is to be in charge of this department, with the title of chief in animal chemistry, and assistants are to be provided for physiological, bacteriological, and analytical work. It is intended to confine the laboratory investigations entirely to studies in animal nutrition.

Indiana Station.—The legislature has appropriated $100,000 for the erection and equipment of a station building. A feeding stuffs control law has also been enacted, to be in charge of the station, with a tax of 20 cents per ton to meet the expense. Any surplus revenue from this inspection is made available for general purposes.

Kansas College and Station.—Appropriations aggregating $544,000 for the college and $57,000 for the Fort Hays substation have been granted by the legislature for the next biennium. The appropriations include $70,000 for the erection and equipment of a building for domestic science and art, a like sum for a veterinary building, $80,000 for an engineering building, and $11,500 for farmers' institutes. The aggregate is one-half as large as the entire amount given by the State during the previous forty-four years' history of the college. Bills were also passed providing for the inspection of feeding stuffs and fertilizers. The administration of these acts is to be in the hands of the station, which is authorized to collect a tonnage tax and apply the surplus for general purposes.

Louisiana University and Stations.—A small addition has recently been made to the pathological laboratory at the Baton Rouge Station for the purpose of giving additional room and better control of incubators and sterilizers. A hospital 26 by 20 feet, and a breeding room of the same size, are being erected for work in animal pathology. An Angus bull and heifer have recently been purchased for breeding purposes.

H. P. Agee, assistant chemist and sugar maker at Audubon Park, is spending the grinding season with one of the largest mills in Cuba.

A new chemical laboratory to cost $40,000 is to be erected for the use of the university.

Maine University.—An appropriation of $130,000 has been made by the legislature for maintenance during the next biennium, besides $90,000 for new buildings, including an agricultural building and a central heating plant. A protracted contest to compel the abolition of the B. A. degree was unsuccessful.

Maryland Station.—Raymond Outwater, assistant chemist, died February 9. The vacancy has been filled by the appointment of Lewis W. Fetzer, Ph. D. (Munich), of New York. M. N. Straughn resigned March 1 to accept a position with the Bureau of Plant Industry of this Department, in connection with the sweet corn investigations. He will be succeeded as assistant chemist by J. J. T. Graham, at present assistant in the State work of the college.

Massachusetts College and Station.—James Draper, trustee of the college and for many years chairman of the committee on the experiment station, died March 14. C. S. Pomeroy has been appointed assistant horticulturist in the station, and E. C. Proulx, assistant chemist, has resigned to accept a position at the Indiana Station. The governor has approved the bill changing the name of the station to Massachusetts Agricultural Experimental Station.

A chair of floriculture has been established, and is to be in charge of E. A. White, now botanist at the Connecticut College and Storrs Station, who will enter on his duties at the close of the college year. Francis Canning, instructor in floriculture, has accepted a commercial position in Pennsylvania.

A summer school of agriculture for teachers is to be held, commencing July 8 and continuing four weeks. This is in line with the recommendations of the State Industrial Commission and recent acts of the legislature. Special attention will be given to the methods of teaching school and home gardening and general nature study.

Montana College and Station.—Increased appropriations for maintenance during the next biennium and for new buildings were made by the legislature at its recent session. The college received for maintenance $50,000, an increase of $14,000, besides an appropriation of $80,000 for an agricultural building. For farmers' institutes $15,000 was appropriated, an increase of $7,000, and for the purchase of pure-bred stock, $5,000. The station was given $15,000 for maintenance and $6,000 for experiments in dry farming, an increase in each case of 50 per cent.

A permanent substation for dry farming was established in Fergus County, with $1,000 per year for maintenance. The county is to contribute 160 acres of land and at least $3,000 for buildings. Cooperative work has been arranged for with the Bureau of Plant Industry of this Department and the cooperative work with the Northern Pacific and Great Northern railways will be continued, these corporations having offered to contribute from $4,500 to $5,500 for this purpose.

In response to a demand for fruit investigations $500 was appropriated for the establishment of a horticultural substation. A perpetual water right and 15 acres of land must be given by the community in which it is located.

New Hampshire College and Station.—E. L. Shaw, associate agriculturist, has been appointed to a position in the Bureau of Animal Industry of this Department, and will take up the work July 1.

New York State Station.—M. P. Sweeney, of Colgate University, and P. W. Flint, of the Pennsylvania Station, have been appointed assistant chemists. A. W. Clark has resigned to take up commercial work.

Cornell University.—James G. Needham, Ph. D., professor of biology in Lake Forest University, and also connected with the New York State Entomological Field Station, has been appointed assistant professor of limnology in the department of entomology of the college of agriculture. His duties will include largely research work on the study of life in marsh and inland waters. It is said that the course has heretofore never been offered in any university.

North Dakota Station.—An annual appropriation of $7,500 has been made by the legislature for additional bulletins, the establishment of 12 demonstration farms, experiments in the manufacture of denatured alcohol, and other purposes.

Ohio Station.—D. L. Sampson has been reappointed a member of the board of control. At its annual meeting T. C. Laylin was elected president, D. L. Sampson, secretary, and John Courtright, treasurer. A department of nutrition investigations was established under the direction of E. B. Forbes, of the Missouri University and Station, who is expected to begin his work during the summer. An extension of one of the station buildings has provided additional office facilities.

Oklahoma College.—The short course held this winter was an unprecedented success, there being about 500 farmers in attendance. The keynote of the meeting was agricultural education of the farmer, both at home and in college.

A plan for movable schools, suggested by Prof. John Hamilton of this Office, aroused special interest.

Pennsylvania College.—Gen. James A. Beaver, ex-governor of the State, judge of the superior court, and president of the college board of trustees, has been elected president of the college, and Dr. Judson P. Welsh, principal of the Bloomsburg State Normal School for many years, vice-president and business manager.

Rhode Island College and Station.—G. E. Adams, associate agronomist in the station, has been elected professor of agriculture in the college to succeed F. W. Card, whose resignation takes effect June 30. L. F. Whipple succeeds W. F. Purrington, whose resignation has been previously noted, as assistant chemist in the station.

South Carolina Station.—C. C. McDonnell has resigned as assistant chemist to accept a position in the Bureau of Chemistry of this Department.

South Dakota Station.—The legislature has passed a bill directing the selection of common school, endowment, or indemnity lands in 3 sections of the State for experiment stations. A bill was also passed granting 25,000 acres of land to these stations for their support.

Tennessee University and Station.—A State appropriation of $100,000 has been made for the next biennium. Of this amount, $25,000 is to be used for salaries, $40,000 for an agricultural building, $22,000 for repairs and equipment, $3,000 for the transportation of the holders of scholarships, of which three have been established for each member of the legislature, and $10,000 for cooperative experiments in agriculture and agricultural extension work in middle Tennessee. A separate bill also appropriates $40,000 for the establishment of a permanent substation in West Tennessee.

Virginia College and Station.—A. M. Soule, dean of the college and director of the station, has tendered his resignation, to take effect September 1, at which time he will go to Georgia to take charge of the agricultural work at the university.

Utah College and Station.—J. A. Widtsoe has been elected to succeed W. J. Kerr as president of the college, and E. D. Ball director of the station in succession to P. A. Yoder.

Washington College and Station.—An appropriation aggregating $575,754 has been made by the State legislature for the ensuing biennium. Of this $130,000 is for a library and auditorium, $125,000 for a general recitation building, $25,000 for a domestic economy building, $12,000 for an engineering laboratory for hydraulics and irrigation, $11,000 for a wing to the veterinary hospital, $12,000 for additional farm lands, $7,000 for barns, $10,000 for farmers' institutes, $4,000 for investigations with cereals and in dry-land farming, $2,500 for irrigation investigations, $20,000 for the Puyallup Substation, and the balance for maintenance. A two-year forestry course has just been arranged, and a chair of farm management is to be established.

West Virginia Station.—E. B. Copeland, who, as previously announced, was elected horticulturist, has decided not to accept the position, but will continue in his present position with the Philippine department of agriculture.

Wyoming University and Station.—The property formerly belonging to the State penitentiary, which has been occupied by the university and station for some time, has been formally granted by the legislature to the university, together with an appropriation of $5,000 for its equipment for experimental work. An appropriation of $2,500 for farmers' institutes was also made.

Office of Experiment Stations.—C. B. Smith, for several years in charge of the departments of horticulture and forestry of *Experiment Station Record*, has

been transferred to the Farm Management Investigations of the Bureau of Plant Industry, and has been succeeded by E. J. Glasson of that Bureau. B. P. Fleming has been appointed irrigation engineer in the New Mexico Station.

New Experiment Station at Grignon.—An experiment station of vegetable physiology and pathology is to be established at Grignon, France, under the directorship of Doctor Griffon. It will be quite distinct from the agronomical station founded by Deherain, and will be devoted entirely to work with plants.

Commission on Organization and Policy in Agricultural Research.—President L. H. Bailey, of the Association of American Agricultural Colleges and Experiment Stations, has appointed the commission provided for at the last convention to inquire into the organization and policy which should prevail in the expenditure of public funds in agricultural research, as follows: As representatives of scientific men not connected with official agricultural research, President David Starr Jordan, of Leland Stanford University, and President Carroll D. Wright, of Clark College; from the research workers of the association, Dr. H. P. Armsby, of the Pennsylvania Station, and Dr. W. H. Jordan, of the New York State Station; and from this Department, Gifford Pinchot, of the Forest Service. President Jordan is to be chairman of the commission.

Agricultural Measures Passed by Congress.—In addition to the agricultural appropriation act, which contained considerable legislation and is summarized elsewhere in this issue, provision was made for the establishment of an agricultural bank for the Philippines, the removal of certain restrictions on the manufacture of denatured alcohol, and for the printing of 250,000 copies of the report of this Department on the diseases of the horse. Agricultural colleges were also made depositories for all public documents. Among the measures which failed of passage were the various bills for the support of branch experiment stations, agricultural high schools, agricultural instruction in normal schools, and additional agricultural colleges in Congressional districts.

Agricultural School at St. Lawrence University.—Additional plans have been announced concerning this institution. According to *American Agriculturist* a school of secondary grade is contemplated, which will cooperate, rather than compete, with the college of agriculture of Cornell University. The leading objects will be the training of practical farmers and farmers' wives. A common school education will be required for admission, but there will be no entrance examinations. Particular attention will be given to the needs of northern New York. Special farmers' courses are contemplated, and various forms of extension work are to be carried on so far as practicable.

A tract of land adjoining the university has been secured for the school and negotiations are proceeding for a farm of 70 acres for experimental purposes. A main building is to be erected at once. This will be a substantial three-story stone structure, and will contain recitation and lecture rooms, laboratories, libraries, an assembly hall, and rooms for domestic science, manual training, and blacksmithing. It is hoped to undertake some instruction of a preliminary nature next fall and to have a formal opening in the spring of 1908.

K. C. Davis has accepted the position of dean which, as previously announced, was tendered him some time ago.

Graduate School of Agriculture in 1908.—The committee on graduate study of the Association of American Agricultural Colleges and Experiment Stations has decided to hold the next session of the graduate school at Ithaca in the summer of 1908. Dr. A. C. True, of this Office, has again consented to serve as dean.

Agriculture at Cambridge University.—The professorship in agriculture at Cambridge was established in 1899, in consequence of an offer by the Worshipful Company of Drapers to contribute $4,000 a year for ten years for its support.

This offer has just been renewed for a second period of ten years, and the chair is henceforth to be designated the "Drapers' Professorship of Agriculture." As previously noted, the Drapers' Company has also offered $25,000 toward buildings and equipment, for which $100,000 is desired. From other sources $35,000 has already been pledged. It is also hoped to increase the annual income by $3,000, as the number of students in agriculture is rapidly increasing and additional aid is required. Efforts to establish a department of forestry are under way and a beginning has been made toward a forestry museum.

Rural Education in England.—At a special meeting of the Lincolnshire Chamber of Agriculture resolutions were passed urging that a more decided agricultural tone should be given to the teaching in the rural elementary schools, and that a complete and consecutive system of secondary education should be established in the rural districts.

The Lincolnshire Farmers' Union recently submitted to all candidates for the county councils in Lincolnshire a series of questions as to their attitude on the introduction of nature study into the rural schools, the keeping of school gardens, and the providing of more definite instruction in rural economy.

A New Experiment Station in the French Kongo.—An order has been issued for the establishment of the Trial Garden of Como at Agonenzork to investigate the culture of cacao and rubber trees. The garden is to be in charge of a subinspector of colonial agriculture. M. Buchet has been designated for this position and also as director of the Trial Garden at Libreville.

New England Conference on Rural Progress.—The first conference on rural progress in New England was held at Boston March 8. Its purpose was outlined by President Butterfield, of the Massachusetts Agricultural College, with whom the idea originated, as a demonstration of the unity of New England in its interests which make for progress. He urged especially closer cooperation of existing agencies, such as the State boards of agriculture, the agricultural colleges and experiment stations, the State federations of churches, State departments of education, and the grange. All of these interests were represented at the conference, the speakers, including E. D. Howe, of Massachusetts, and H. O. Hadley and N. J. Bachelder, of New Hampshire, for the grange; H. J. Wheeler, of the Rhode Island Station; G. H. Martin, secretary of the Massachusetts State Board of Education; L. R. Jones, of the Vermont University and Station; W. D. Hurd, of the University of Maine; E. T. Hartman, secretary of the Massachusetts Civic League; Rev. E. T. Root, field secretary of the Massachusetts Federation of Churches; G. M. Twitchell, of the *Maine Farmer*, and A. E. Stene, of the Rhode Island College. It was decided not to attempt a permanent organization at that time, but to hold another meeting in the spring of 1908, at which time a committee is to report a detailed plan of organization.

New Forestry Journal.—We note the establishment of the *Quarterly Journal of Forestry*, under the auspices of the Royal English Arboricultural Society in conjunction with the Irish Forestry Society, and edited by A. C. Forbes. The publication is said to be the result of the rapid growth of the first-named society, together with the increasing interest taken in all matters relating to forestry. The initial number includes the transactions of the Royal English Arboricultural Society, an explanation of the purpose of the Irish Forestry Society, current topics and articles, notes on practical forestry, and reviews and abstracts of forestry literature.

Second International Congress of Agricultural Mechanics.—Official announcement is made that this congress will meet as a section of the Eighth International Congress of Agriculture, to be held in Vienna May 21–25, 1907. Special attention is to be given to the establishment of uniform international rules for the examination of agricultural machinery, and a report on this subject is to be

submitted by a committee appointed at the last congress at Liège. Other problems to receive consideration will be the organization of exhibits and competitions of farm machinery and the promotion of conditions tending toward its more extensive use, and the development of instruction in agricultural mechanics. The secretary of the congress is Prof. Josef Hausler, Schlautlergasse 6, Vienna, to whom applications for registry should be addressed.

Argentine Republic to Test von Behring Treatment for Tuberculosis.—According to *Breeders' Gazette* the Argentine Republic is to make an extensive trial of the von Behring treatment for tuberculosis. P. H. Römer, an assistant of Doctor von Behring, has been secured for one year to equip a hospital in Buenos Ayres for the treatment of cattle in quarantine which have reacted to the tuberculin test on importation. Animals failing to respond to the treatment after six months will be destroyed. "Cures" will be kept under supervision for three years and then killed and given a thorough post-mortem examination. It is hoped in this way to decrease materially the present heavy losses from tuberculosis.

Boys' and Girls' Contests in Kansas.—An attempt is to be made to extend the boys' corn contest held last year in 47 of the 105 counties of Kansas to the entire State, and to arrange for additional boys' and girls' contests in growing dwarf milo maize, durum wheat, sugar beets, garden crops, potatoes, and flowers, and in baking, sewing, mending, and canning. This movement is under the supervision of the State superintendent of farmers' institutes, but the details of the contest will be left largely with the county organizations. It is recommended that the prizes consist in part of trips to the agricultural college at the time of the winter institutes and State contests.

Department of Nutrition of the Carnegie Institution.—The Carnegie Institution has decided to locate its laboratory for the study of problems in human nutrition in Boston, where a site has been obtained in close proximity to the new buildings of the Harvard Medical School and near several hospitals. The laboratory will contain a respiration calorimeter and is to be equipped with complete accessory apparatus.

Necrology.—Sir Michael Foster, the distinguished physiologist, author of the well-known Textbook of Physiology, and the successor of Huxley as Fuller professor of physiology in the Royal Institution, died January 29 in his seventy-first year. For twenty-two years he was secretary of the Royal Society of Great Britain, professor of physiology in the University of London since 1869, professor of physiology at Cambridge from 1883 to 1903, and since 1901 president of the Royal Commission on Tuberculosis. He was well known and held in high esteem in the United States, where he delivered a series of lectures on the history of physiology before the University of California.

J. Vilbouchevitch, founder and editor of the *Journal d'Agriculture Tropicale*, died January 27. He was born at Bielostok, Russia, June 24, 1868, and educated at the Agricultural Academy of Moscow. In 1889 he made a study in France of alkali soils, their flora and culture, publishing a work entitled *Les Plantes Utiles des Terrains Salés* in 1892. On his return to Russia he assisted in the organization of the horticultural exposition in St. Petersburg, and was for several years attached to the Russian ministry of agriculture, studying reforestation and related problems. In 1901 he founded in Paris the *Journal d'Agriculture Tropicale*, which soon became an important factor in the development of tropical agriculture, particularly in the French colonies.

The death is announced of Prof. William von Bezold, director of the Prussian Meteorological Institute. In 1878 he was made director of the Central Meteorological station in Bavaria and organized the meterological service in that country, remaining in that position until 1885, when he accepted the director-

ship of the Prussian Institute. Among his contributions to meteorology were papers on the thermo-dynamics of the atmosphere, which are the classical memoirs on that subject. He was also greatly interested in the theory of terrestrial magnetism.

Dr. Allen MacFayden, a distinguished English bacteriologist, died March 1, as the result of accidental infection in the laboratory. Among his investigations were studies of the bacteria in the digestive tract, bacteria thriving in high temperatures, and the effect of low temperatures on micro-organisms. He devised a method of grinding bacteria with liquid air and showed that the "endotoxins" thus obtained could be used for immunizing. The application of his results to the treatment of human diseases had occupied his attention in recent years. He was prominently connected with the establishment and management of the Lister Institute of Preventive Medicine, and from 1901–1904 was Fuller professor of physiology at the Royal Institution.

Dr. Guido Krafft, professor of agriculture in the technical high school at Vienna and a well-known agricultural writer and editor, died February 22, at the age of 62 years.

Miscellaneous.—We note from *Science* that a gift of $400,000 has been received by Teachers College of Columbia University for a building for its school of domestic economy.

The Society for Horticultural Science and the American Pomological Society will hold their next meetings on the grounds of the Jamestown Exposition, September 25 and 26.

Dr. D. E. Salmon, formerly chief of the Bureau of Animal Industry of this Department, has sailed for Montevideo, Uruguay, where he will assume charge of the veterinary department in the university of that city.

A. F. Burgess, secretary of the Association of Economic Entomologists, has resigned as State inspector of orchards and nurseries for Ohio and taken up experimental work in Massachusetts with insecticides for the destruction of the gypsy and brown-tail moths.

Silas C. Mason, for several years professor of horticulture and forestry at Berea College, Kentucky, has resigned to accept a position in the Bureau of Plant Industry of this Department, in connection with the work upon plant life history. He has been sent to Arizona, where he will make a field study of plants of economic importance in the semiarid and arid regions.

The Goldsmiths Company has given $50,000 to the Rothamsted Experiment Station for investigations on soils.

A subscription has been opened in Austria for the erection of a monument to Gregor Mendel, the discoverer of the laws of heredity bearing his name. Prof. E. von Tschermak is president of the committee, the American members of which are W. A. Cannon, Desert Laboratory, Tucson, Ariz., and C. B. Davenport, Cold Spring Harbor, N. Y.

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EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, Ph. D., *Assistant Director.*

EDITORIAL DEPARTMENTS.

Meteorology, Soils, and Fertilizers—W. H. Beal.
Agricultural Botany and Vegetable Pathology—W. H. Evans, Ph. D.
Field Crops—J. I. Schulte.
Horticulture and Forestry—E. J. Glasson.
Zootechny and Human Nutrition—C. F. Langworthy, Ph. D.
Agrotechny, Dairy Farming, and Dairying—H. W. Lawson.
Agricultural Chemistry—W. H. Beal, C. F. Langworthy, and H. W. Lawson.
Economic Zoology, Entomology, and Veterinary Medicine—E. V. Wilcox, Ph. D.
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Agricultural Education—D. J. Crosby.

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VETERINARY MEDICINE.

RURAL ENGINEERING.

LIST OF EXPERIMENT STATION AND DEPARTMENT PUBLICATIONS REVIEWED.

Stations in the United States.

U. S. Department of Agriculture.

NOTE.—The publications of the United States Department of Agriculture, except those of the Weather Bureau, may be purchased from the Superintendent of Documents, Washington, D. C. For the publications of the Weather Bureau requests and remittances should be directed to the Chief of the Bureau. The price of the Record is $1 per volume, or 10 cents per number. The prices of other technical publications are given in the list above. The publications of the State experiment stations are distributed from the stations and not from the Department.

EXPERIMENT STATION RECORD.

Vol. XVIII. May, 1907. No. 9.

The completed plans of the experiment stations for investigations under the Adams Act contain much of interest and encouragement to all who have a high ideal for experiment station work. These plans have been worked out with unusual care and deliberation, and, taken as a whole, they embody a large amount of investigation in the true sense, which will place agricultural science and research upon a higher plane. Considering the conditions under which the first year's work had to be planned, the difficulties of securing men, the lack of uniform standards, and the like, the programme must be regarded as very satisfactory.

While it is not planned to publish the projects presented by the different stations, a review of the list as a whole, with some of its salient features, will indicate the character and high grade of the work proposed, and the broad field which these investigations cover. When it is considered that most of the subjects are to be studied through a period of several years and that the plans for many of them will be further developed as the investigation progresses, it will be evident that a new régime has been entered upon in the conduct of our stations, which will make them contribute in a large way to the unfolding of the principles upon which agricultural development and practice rest. Not only is the amount of investigation vastly increased, but the outlining of the various undertakings in advance has had the effect of systematizing our work more thoroughly than ever before, and ultimately this should reflect favorably upon the activities of the station as a whole.

As was natural to expect from the present interest in the subject, a large number of projects were proposed in plant breeding. Investigations in this line must, of course, discriminate clearly between random efforts at improvement in a broad way and the more systematic effort to attain a definite end. Breeding for improvement should have an ideal in view and be conducted in the endeavor to attain that object in a scientific way, taking advantage of all that is known, and keeping such records that the manner in which the ultimate result is attained can be definitely described. The element of

chance is prominent enough in plant breeding at best. The breeding work projected under this new fund has been given a definiteness of purpose, has been restricted to limits within which it could be carefully followed, and in a considerable number of instances has been so planned as to contribute to a better understanding of the principles of breeding.

It is proposed, for example, to make thorough studies upon heredity in plants, the variability in morphological characters in cultivated wheat, the extent of hybridizing in nature and the environmental conditions associated therewith, effects of external environmental factors upon hereditable morphological characters, and the correlation of visible morphological characters with the presence and distribution of such constituents as gliadin, glutenin, and starch in the grain. Corn breeding for the semiarid region is being taken up from the standpoint of the factors which constitute drought resistance as a basis for such breeding, and the development of immune or disease-resistant strains of crops on the basis of studies upon what constitutes immunity in different cases, and the principles underlying development of disease resistance. These physiological studies will take up anatomical and chemical phases of the subject, such questions as the functions of tannin in the economy of the plant, its presence in pathological tissues, effect on parasites, etc.

In general, the pathology and physiology of disease is to be studied in a more comprehensive way than heretofore, taking up such matters as the relation between the character of the soil and certain diseases, notably the relation of marly soils and of lime to chlorosis of citrus fruits, the specific influence of the different factors which go to make up climate upon health and susceptibility to disease, and the relation of nutrition to the latter. Naturally a quite large number of plant diseases are to be made the subject of systematic study. In some cases these are new or little understood diseases, and in others the object is to clear up doubtful points as to the organisms inducing them, their life cycle, relationships, susceptibility to various influences, means of dissemination, etc., as a more intelligent basis for combating them. There is opportunity for much profitable work of this kind, for in the pressure for results which should indicate remedies to be applied it has often been impossible to go as deeply into the nature and cause of the disease and the influences affecting it as is clearly desirable.

The same is true to a considerable extent in the case of economic insects, and the use of sprays and other treatment. Now that the opportunity is offered, it is found desirable to go back to some of our most common insect pests and study more thoroughly certain points in their habits and life histories, environmental conditions which affect them, and similar matters, as bearing ultimately on

methods of control. The entomological work proposed is, as a whole, of high order, indicating for the most part a clear conception of the features of research and an appreciation of its importance as applied to that branch of science. The list of projects is also relatively large and varied. Several investigations have to do with the toxicity of various insecticides, the manner in which they act, and similar points, as well as their physiological effects on the trees and plants receiving the treatment.

The number of investigations proposed in horticulture, aside from those in breeding, is not large, a fact which is somewhat disappointing in view of the opportunities which this division of agriculture presents for thorough investigation and the undeveloped state of horticultural science. There are several physiological studies, however, which are of special interest and importance, such as the causes and means of control of fruit-bud formation on the apple, the physiology and philosophy of pruning and of grafting, both of which as planned involve extensive systematic studies, the elimination of the color of peach twigs by breeding to make them less susceptible to early frost, the factors affecting the setting of fruit on the tomato, to determine the cause of failure to set in dry localities where the plants bloom freely, and other studies of the effect of environmental conditions.

The subject of dry farming, in which there is such active interest of late, naturally suggested a considerable number of projects, and here the necessity for the differentiation for scientific study is well illustrated. Dry farming, like farm management, is evidently not a division of agricultural science, but rather a branch of agricultural practice conducted under certain climatic conditions. The furnishing of a more scientific basis for it in place of the results of simple tests and demonstrations must depend upon investigations in chemistry, physics, agronomy, physiological botany, plant breeding, and various other lines, as related to definite phases of the general subject. Hence a number of special investigations have been undertaken, such as the absolute water requirements of plants, the periodicity of this requirement, the water-holding capacity of the soil and factors which affect it, the conservation of the soil moisture, the breeding of drought-resistant crops, and the like. Many of the problems in dry farming are mechanical and purely local, and the more general trials and demonstrations have been left to other funds.

Soil fertility is another topic which has attracted much investigation on account of the renewed interest in the subject; but here, as in dry farming, the necessity for differentiation of the broad subject has been apparent. The large number of soil investigations is a noteworthy feature of the list of projects. Aside from studies of the fertilizer requirements of soils by field and laboratory methods, and

the composition of certain crops as indicative of these requirements, the work includes the nature and extent of the influence exerted upon crops by the previous growth of other kinds of plants, the relation between soil conditions and the quality of crops, such as the staple of cotton, the effect of sodium salts applied to the soil upon the organic and inorganic constituents of plants, the rôle of phosphorus and of potassium in plant nutrition, and the rôle of lime in the soil.

There are also several projects dealing with humus, its nature and determination, relations to soil fertility, rate of formation under different conditions, behavior and conservation in the soil, and effect of various factors on the humus content. To these are added studies in soil bacteriology as related to humus formation and change, relation of microscopic life of the soil to fertility in general, nitrifying and other biological properties of the soil, determination of the number, character, and biochemic functions of bacteria within the zone of tillage, to ascertain the part these organisms play singly and collectively in the setting free of plant food, and the bacteriological conditions in irrigated and unirrigated soil in the arid region, with special reference to the formation of nitrates and to the decomposition of barnyard manure. The number and character of these investigations give much encouragement for a better understanding of the complex factors which go to make up soil fertility and adaptation.

Closely related to these studies are various chemical investigations on plants and their products, such as the nonsugars in sugar cane, their nature and amount, and the conditions which affect their formation, with special reference to sugar manufacture; the gluten content of wheat, cause of its deterioration and methods of correcting, the milling qualities of wheat as related to this and other factors, and the factors affecting the lupulin, volatile oils, and other active principles of hops. An investigation of the various sugars and coloring matters in cacti is also in progress, and the rationale of the ripening of the date is to be taken up.

Animal nutrition does not claim a large number of investigations, but these are of quite a different type from the ordinary feeding and digestion experiments to which the work has in the past been quite largely confined. Digestion experiments have been undertaken with reference to some particular point, rather than the determination of digestion coefficients for themselves. Among these are the behavior of the constituents of the nitrogen-free extract in digestion and their relation to nutrition, the influence of certain feeding stuffs in depressing the digestibility of rations, and the nature and cause of this effect, the process of digestion as influenced by certain factors, and the effect of treatment or preparation of the feed on the digestibility of its constituents. Among the fundamental studies in animal nutrition are the influence of age and individuality on metabolism in cattle, an

extensive investigation upon the use which animals actually make of their food at different periods of growth, considered from a physiological standpoint, the rôle of phosphates in animal nutrition, the effects and importance of various other mineral constituents, and the specific effect of certain foods on the product, such as the hardness or solidity of pork and the character of the fat in butter.

In dairying there are also comparatively few projects, which may be taken as an indication that attention is being turned in that direction far less than a few years ago, or that men are lacking to take up the more fundamental problems in this field. There are several quite elaborate projects dealing with the less understood properties of milk and their relation to differences in its nutritive value and the manner in which it agrees with people, but aside from these the dairy work is quite largely on the bacteriological side. Investigations are proposed upon bacteria other than disease germs in milk which are detrimental to digestion, the leucocytes in milk under normal and abnormal conditions and their sanitary significance, the constituents of cheese and their changes under the influence of certain classes of bacteria, and bacteriological and chemical investigations upon the disposal of creamery sewage, which is found much more resistant than municipal sewage, necessitating modification of the septic tank method.

In animal breeding investigations are to be made in heredity and upon the effects of inbreeding, the latter being planned to be the most systematic attempt ever made to study the effects of inbreeding upon domestic animals. In other investigations the breeding of animals under normal and abnormal conditions is to be studied, the effect of certain feeds like cotton-seed meal upon prepotency, and the whole problem of artificial impregnation. It is encouraging to see the breeding of animals taken up in a way to contribute more exact and reliable knowledge. Several other investigations in that field are being planned.

Veterinary science presents quite a list of undertakings of a thorough character relating to specific diseases, the immunizing of animals, with a study of the causes of natural immunity, stable ventilation in relation to the requirements of health, the active principles of plants poisonous to stock, and several quite elaborate studies upon the life history of the cattle tick as related to Texas fever eradication.

Several less usual topics are a study of the conditions in the incubation of eggs under the hen as regards gases and physical factors, and their reproduction in artificial incubation; the optimum conditions for artificial incubation in dry climates; conditions determining the egg-laying capacity of fowls, and the fertility of eggs; the cause of decay in eggs; and an investigation into the factors influencing wool production, the scouring of wool, and related topics.

This list is in no sense a complete one in scope or extent, and only hints at some of the salient features of the programme for investigation. It serves to show something of the variety of topics undertaken, and indicates in a general way the character of the work. It will be evident that the subjects have been selected in a discriminating manner, and are being attacked in a way to give a scientific answer which will disclose the various factors which are operative and something of their relative importance. In this respect a large proportion of the work is undertaken from a somewhat different point of view from that which has more commonly prevailed, and there is evident intention to systematize the inquiry and make it thorough as far as it goes. There is an absence of experiments or trials which aim solely at an immediately practical answer, without regard to the scientific aspects of the case. Throughout the list of projects there is an attitude of inquiry, an attempt to get at the reason for results and phenomena, in order that deductions and generalizations may be made on a sound basis of science.

The working out of these projects in considerable detail has in itself been a somewhat new experience for a considerable proportion of station men, whose work has not always been characterized by a systematic and well-digested plan. The plan has frequently grown up with the experiment itself, and this has affected the conduct of the work at different stages and necessarily the final result. If the system inaugurated for the Adams fund projects shall become more generally applied to the station work as a whole it will be an important result of the first year's operations under the new act. Its advantage to the station worker and in the administration of the station must be evident. Only by some such means can the director keep informed upon the work of various departments, arrange for necessary cooperation to strengthen the investigations, and follow up the investigations from year to year.

One of the great needs of our stations has been a more thorough systematizing of their work—not that the individual initiative of the workers is to be restricted or the position of the workers subordinated in any way; but viewing the work of the past it must be evident that quite a proportion of the station work has lacked in efficiency from not having a sufficiently definite aim and thoroughly considered plan, and not having the necessary continuity. Frequently much well-planned work has been interrupted or dropped before results of any value could be secured; and on the other hand the value of many experiments has been largely nullified by lack of support from some other department of the station. The control of these matters, so vital to the efficiency of station work, is an administrative function, and more than any other single thing calls for the guidance and inspiration of a competent administrative officer. The

interruption of experiments and investigations is by no means always attributable to the station worker, or to the director himself, but with a more systematic arrangement of the station work, and a closer and more sympathetic contact with it, many of the present disturbing factors might be avoided.

Now that every station has given serious attention to the planning of research and has made that an important phase of its activity, attention may well be turned to the strengthening of the station organization for such work and the bringing of the station work as a whole into harmony with it.

In a recent article, Doctor Pritchett, speaking of another subject, says: "Perhaps at our present stage of development in such matters no other preliminary work needs more to be done than some work of popular education relative to what research is." This applies with peculiar force to the subject of agriculture. Our ideas are not yet entirely clear as to what research in agriculture really is, and the general public has only the faintest glimmer of its importance in comparison with other grades of work. Systematic effort will therefore be needed to develop an intelligent appreciation of research in agriculture and of its ultimate importance in making real progress possible.

The death of Prof. Robert Warington, at Harpenden, England, on March 20, will call to mind the excellent course of lectures given before the Association of American Agricultural Colleges and Experiment Stations in 1891, by the first representative sent to this country under the provisions of the Lawes Agricultural Trust. Professor Warington made many friends on that occasion, who gained from him inspiration for exact and painstaking investigation, as well as a clearer insight into the plan and method of the systematic work at Rothamsted. The news of his death will be received with much regret.

From an article in *Nature*, by the present director of the Rothamsted station, it is learned that Warrington was born in 1838, being the son of a chemist of prominence, from whom he learned his first chemistry. In 1859 he worked for some time as a voluntary assistant in the Rothamsted laboratory, and in 1862 went to the Royal Agricultural College at Cirencester as assistant to the late Dr. Augustus Voelcker. In 1867 he became chemist at Sir John Lawes's tartaric acid works, and in 1876 returned to Rothamsted, where he remained until 1890.

"On his return to the Rothamsted laboratory in 1876, Warington introduced several improved methods of analysis to save time or insure greater accuracy in the routine determinations: there also he carried out the investigations on nitrification by which he made his name. In 1877 appeared the paper of Schloesing and Müntz,

which showed that the production of nitrates in the soil must be due to living organisms. This work was repeated by Warington, who continued to investigate the conditions favorable to the process. He showed that light would inhibit the change and that the drying of the soil was sufficient to destroy the organism: he also investigated the distribution of the organism, and showed that it was confined to the surface layers of ordinary soil, being only present in any quantity in the portion usually stirred by the plow.

"Observing that the oxidation of the ammonia or urea employed sometimes stopped at the stage of nitrite, he succeeded in demonstrating that the process in ordinary soils takes place in two stages due to different organisms—one oxidizing ammonia to nitrous acid, the other completing the oxidation to nitric acid. Warington had actually accomplished the final step in the isolation of the two organisms, though he had not brought his work to the stage which satisfied himself, when his researches were unfortunately interrupted, and before he could resume Winogradsky published his elegant method of isolating the nitrous and nitric organisms by the use of a nutrient silica jelly. The circumstances which led to Warington thus missing the credit of the crowning point of his long researches on nitrification undoubtedly caused him bitter disappointment. He continued to live in Harpenden, but took no further part in research.

"In the course of his investigations on nitrification, Warington also observed and studied that other process of denitrification, by which previously formed nitrates are reduced again, often with loss of the nitrogen as gas. In later years this subject became very prominent for a time, but the essential conditions of the action had been laid down before in Warington's papers. He also investigated the method of estimating small quantities of nitrates by means of indigo, and devised a standard process which, in a simplified form, is now used by most water analysts. . . .

"Warington's scientific work is distinguished by clearness and precision. The range is not wide, but everywhere it shows the minute care and the regard for accuracy with which he worked. In these respects his work only reflected his personal character."

He was Sibthorpian professor of rural economy at Oxford from 1894 to 1897, a chair held for several years by Sir Henry Gilbert. His little book on the Chemistry of the Farm, first published in 1881, has gone through fifteen editions. He was a fellow of the Royal Society and the Chemical Society, being vice-president of the latter from 1889 to 1893. Since 1894 he had been examiner in agricultural science to the board of education.

Professor Warington's health began to fail about a year ago, when he underwent an operation, which greatly benefited him for a time, but eventually a recurrence of the malady led to his death.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

A single standardizing material for acidimetry and alkalimitry, E. Rupp (*Chem. Ztg., 31 (1907), No. 9, p. 97*).—The author tested with success and recommends for this purpose weak solutions (preferably tenth-normal) of carefully purified borax to which glycerin or mannite is added.

On the rapid determination of carbon dioxid in confined and free atmospheres, A. Müntz, E. Lainé, and R. Gallois (*Ann. Inst. Nat. Agron., 2. ser., 5 (1906), No. 1, pp. 13–30, figs. 4*).—A titrimetric method is described in which the carbon dioxid evolved is absorbed in dilute alkali, the excess of alkali being titrated with a solution of sodium bicarbonate, using Poirrier's blue as an indicator. By means of a special apparatus, which is fully described, the carbon dioxid as it is evolved is made to pass through the alkali solution very slowly and in a very fine state of division, thus insuring perfect absorption. The fine division of the gas bubbles is secured by means of a special device which forces the gas to pass through a soap solution.

The method was successfully applied to confined air and to the free atmosphere in the garden of the National Agronomic Institute at Paris. In a series of observations in the latter case the amount of carbon dioxid in the atmosphere varied from 2.87 to 3.24 parts per 1,000.

On a new method for the determination of ammonia in waters, A. Buisson (*Compt. Rend. Acad. Sci. [Paris], 144 (1907), No. 9, pp. 493–495; abs. in Rev. Sci. [Paris], 5. ser., 7 (1907), No. 11, p. 338*).—The method is based upon the fact that if mercuric chlorid is added to a solution of an ammonium salt containing sodium carbonate in the proportion of 5 molecules of mercuric chlorid to 2 molecules of the ammoniacal salts ammonia is completely precipitated in the form of a white amorphous compound having the formula $CO_3(Hg_5N_2Cl_2)_2O+3H_2O$.

The method is carried out as follows: Add 5 cc. of a 1 : 4 soda solution to 1 liter of water and distill about 100 cc. into 10 cc. of 1 per cent hydrochloric acid, make the volume to 1 liter, add 10 cc. of a 5 per cent solution of mercuric chlorid and 10 cc. of a 15 per cent solution of sodium carbonate, let stand for 24 hours, collect on a tared filter, wash with 5 cc. of water, dry at 100° C., and weigh. The weight thus obtained multiplied by 0.03 gives the ammonia in 1 liter of water. With water containing less than 1 mg. of ammonia per liter, precipitate in the 100 cc. distillate without dilution.

The results by this method are claimed to be as good as those by ordinary methods.

The determination of manganese in drinking water, H. Lührig and W. Becker (*Pharm. Centralhalle, 48 (1907), No. 8, pp. 137–142*).—The Knorre method, based upon the precipitation of the manganese by ammonium persulphate in boiling solution, dissolving the precipitate, and titrating the solution thus obtained, is recommended.

A delicate reaction for carbohydrates, H. J. H. Fenton (*Proc. Cambridge Phil. Soc., 14 (1907), No. 1, pp. 24–26*).—It has been observed that when bromo

or chloro compounds of typical carbon radicals are acted upon by sodiomalonic ester in alcoholic solution considerable heat is evolved and the mixture turns bright red. When poured into water it gives a solution which exhibits an intense blue fluorescence.

"By taking advantage of the highly sensitive reaction with malonic ester, one may detect the merest trace of bromo-methyl-furfural and this test may consequently serve for the identification of all hexoses, whether aldose or ketose.

"The mode of operating is as follows: A minute quantity of the solid substance to be examined is slightly moistened with water, mixed with a drop or two of phosphorus tribromid gradually heated on a water bath to 90 to 100°, and kept at this temperature until the mixture has turned dark colored. It is then cooled, stirred with a little alcohol and a few drops of malonic ester; alcoholic potash is then added until the solution is alkaline. On now diluting the resulting mixture with a large volume of water, or alcohol, the fluorescence is at once apparent.

"The reaction is strongly marked even with the aldoses, but is, as might be expected, more intense with ketose sugars and with cellulose. In comparison with the other pure hexoses examined, galactose appears to give the weakest indications. . . .

"A saturated aqueous solution of hydrogen bromid may be employed in this test instead of phosphorus tribromid; the latter is, however, preferable in the case of substances which are less readily attacked, such as cellulose. The chlorids of phosphorus may also be used, but their action is perhaps less certain.

"Positive results were obtained with dextrose, levulose, galactose, sorbose, cane sugar, maltose, lactose, raffinose, starches, dextrins, cellulose in different forms, salicin, amygdalin, and the mixture of sugars resulting from the condensation of glycollic aldehyde.

"No indication was given by arabinose, xylose, glycollic aldehyde, mannitol, erythritol, glycerol, gluconic acid, mucic acid or inosite.

"It appears, therefore, that this test may be used for the identification of all hexoses or of other carbohydrates, glucosides, etc., which yield hexoses on hydrolysis."

In the author's opinion, this reaction possesses some advantages over the usual color reaction for carbohydrates in that the effect is restricted to the hexose or polyhexose nucleus.

On a characteristic reaction of milk with sodium or potassium hydroxid, F. Krüger (*Ztschr. Physiol. Chem., 50 (1907), No. 4–5, pp. 293–302*).—The addition to cow's milk of one-fifth its volume of a 40 per cent solution of sodium or potassium hydroxid was found by Gautier and Morel to produce a cherry-red color in 24 hours. The same reaction was obtained with heated as with raw milk. It was not obtained by the use of ammonia. The author concludes from the results of his studies of this reaction that the color does not depend entirely upon the presence of proteids and lactose, but also upon one or more other constituents of the milk.

Contribution to the analysis of milk, E. Carlinfanti and G. Pierandrei (*Arch. Farmacol. Sper. e Sci. Aff., 6 (1907), No. 1, pp. 26–34*).—Determinations of the specific gravity and the nitrogen content of milk serum obtained by means of rennet are considered valuable in detecting the adulteration of milk. The article has special reference to detecting the adulteration of cow's milk with the whey from goat's milk.

The determination of lactose in milk, C. Porcher (*Rev. Gén. Lait, 6 (1906), Nos. 3, pp. 49–56; 4, pp. 73–85*).—The author describes various methods employed for this purpose, concluding that the most generally acceptable method

consists in treating the milk with mercuric nitrate and titrating against Fehling's solution.

The application of cryoscopy to the analysis of milk, E. GRÜNER (*Ann. Ist. Agr. [Milan], 6 (1901-1905), pp. 27-50*).—The freezing point of fresh cow's milk varies, according to the author, between −0.535 and −0.580° C. The variations for mixed milk are usually within −0.55 and −0.57. The freezing point was not influenced by the age of the animals, the stage of lactation, or the feeding stuffs used. A slight influence, however, was attributed to the breed. The freezing point was not materially affected by the composition of the milk. Taken in connection with chemical analysis the determination of the freezing point is believed to afford valuable data in detecting the adulteration of milk with water.

The detection of added water in milk, C. REVIS (*Jour. Roy. Inst. Pub. Health, 15 (1907), No. 1, pp. 39-42*).—The author calls attention to the fact that when genuine milk is deficient in solids-not-fat the deficiency is due to an abnormally low percentage of milk sugar. In endeavoring to ascertain the cause of deficiency in the percentage of solids-not-fat in milk, it is, therefore, considered desirable to determine the amount of sugar. The difficulty lies in making the analysis before much of the milk sugar is decomposed. Adulteration with water is indicated when the amount of sugar is approximately $\frac{13}{24}$ of the solids-not-fat, the total amount being less than 8.5 per cent. When the amount of sugar is considerably less than $\frac{13}{24}$ of the solids-not-fat, the reduction in solids-not-fat is apparently due to natural causes.

Contribution to the refractometric detection of added water in milk, E. ACKERMANN (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 4, pp. 186-188, fig. 1*).—The value of determining the refractometer number of milk as a means of detecting adulteration with water is pointed out. In the author's method the serum is prepared by adding 0.25 cc. of a calcium chlorid solution (specific gravity, 1.1375) to 30 cc. of milk. This is thoroughly mixed and heated in a water bath for 15 minutes. The loss of water in the sample is prevented by means of a return-flow condenser.

With normal milk the author obtains constant numbers with the Zeiss immersion refractometer varying between 38.5 and 40.5. The addition of 5 to 50 per cent of water caused, according to the results reported, a reduction in this number of from 1.3 to 8.1.

The temperature correction of the Zeiss butyro-refractometer, H. D. RICHMOND (*Analyst, 32 (1907), No. 371, pp. 44-46*).—The following are offered as the most probable corrections:

Temperature.	Correction for scale reading.	Correction for refractive index.
15 to 20° C . . .	0.620	0.000372
20 to 25° C . . .	.600	.000372
25 to 30° C . . .	.608	.000380
30 to 35° C . . .	.615	.000393
35 to 40° C . . .	.594	.000386
40 to 45° C . . .	.585	.000380
45 to 50° C . . .	.583	.000385

The Tolman and Munson factor 0.000365 for correcting refractive indices is, therefore, considered inaccurate. The author gives directions for the construction of a correction chart which it is claimed will give very accurate readings for all refractive figures and all temperatures.

A means of distinguishing cocoanut oil from butter and other fats and oils, J. HANUŠ (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 1, pp.*

18–24).—The method suggested tentatively in this preliminary communication depends upon the formation, separation, and saponification of the esters.

To 5 gm. of the melted fat is added 30 cc. of a tenth-normal alcoholic solution of sodium hydroxid. The mixture is thoroughly shaken, allowed to stand for 8 minutes, and neutralized with dilute sulphuric acid. It is then made up to 145 cc. with water and distilled, the alcoholic distillate of 30 cc. being kept separate from the aqueous distillate of 100 cc. The two fractions are washed into Erlenmeyer flasks, alcohol is added to the aqueous fraction, the free acids in both are neutralized, and saponification is effected by the addition of 40 cc. of tenth-normal sodium hydroxid and heating with a return-flow condenser for 45 minutes. The mixture is then titrated against tenth-normal hydrochloric acid, the difference between the number of cubic centimeters required for neutralization and 40 showing the number of cubic centimeters of the tenth-normal sodium hydroxid required for saponifying the esters in 5 gm. of fat.

The highest number of cubic centimeters required for saponifying the esters in the aqueous fraction was 10 in the case of pure butter, while it was very much in excess of that for cocoanut oil.

Detection of cocoanut oil in butter, F. VON MORGANSTERN and W. WOLERING (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 4, pp. 184, 185*).—The method of Wijsman and Reijst (E. S. R., 17, p. 834) was applied by the authors to 20 samples of pure butter, the results showing no constant relation between the first and second silver numbers. In the majority of cases, however, the second silver number was higher than the first. This, according to the conclusions of Wijsman and Reijst, would indicate adulteration with cocoanut oil, which was not the case.

The silver index method of Wijsman and Reijst, H. SVOBODA (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 1, pp. 15–18*).—This method proposed for the detection of cocoanut oil in butter (E. S. R., 17, p. 834) was applied by the author to 80 samples of pure butter. The Reichert-Meissl number with a distillate of 110 cc. averaged 27.29 and with a distillate of 300 cc., 31.03. The first silver index averaged 3.64 and the second 3.91. In 57 of the 80 determinations the second silver index was higher than the first, which was contrary to the results obtained by Wijsman and Reijst. This method is, therefore, considered of no value as a means of detecting the adulteration of butter with cocoanut oil.

On the determination of fat in cheese by the Gerber method, A. SCALA (*Stáz. Sper. Agr. Ital., 39 (1906), No. 8, pp. 734–737*).—Comparative determinations were made with the gravimetric method, the Gerber method, and the Siegfeld modification of the Gerber method. The results by the Gerber and Siegfeld methods were above those by the gravimetric method in 16.6 and 45.21 per cent, respectively, of the 42 determinations made and below in 83.33 and 54.76 per cent.

The chemistry of flesh. V, Methods for the determination of creatinin and creatin in meats and their products, H. S. GRINDLEY and H. S. WOODS (*Jour. Biol. Chem., 2 (1907), No. 4, pp. 309–315*).—Using the colorimetric method described by Folin (E. S. R., 17, p. 165), determinations of the creatin and creatinin in a number of samples of meat and commercial meat extracts are reported. According to the authors, the colorimetric method employed has been successfully used with uncooked and cooked meats, meat products, and drippings. Recorded data show marked differences in the total amount of creatin and creatinin contained in different commercial extracts now on the market.

"Experiments upon meat extracts prepared upon a small scale in the laboratory, from fresh meat, are now under way to find out, if possible, the conditions

which produce the above difference in the relative proportion of creatinin and creatin."

Agricultural chemistry during the second half year of 1906, W. Zielstorff (*Chem. Ztschr., 6 (1907), No. 4, pp. 65–70*).—Recent investigations relating to the nutrition of plants and animals are briefly reviewed.

Abstracts from current literature upon industrial chemistry, F. H. Thorp (*Jour. Amer. Chem. Soc., 29 (1907), No. 3, pp. 349–382*).—The part of this review of special interest to agriculture is that relating to the literature of electro-chemical fixation of nitrogen, fats and oils, fermentation, foods, sugar, and fertilizers (silica as a plant food).

Progress in cellulose chemistry, W. Vieweg (*Chem. Ztg., 31 (1907), No. 8, pp. 85–87*).—A summary of recent literature on the chemistry of cellulose.

The present development of the analysis of tanning materials, H. R. Procter and H. G. Bennett (*Jour. Soc. Chem. Indus., 26 (1907), No. 3, pp. 79, 80*).—This discusses the preparation of hide powders and gives the details of a method for the determination of tannins which, it is urged, should be adopted by the associations interested in this work.

Annual report of the government analyst for 1905–6, P. Carmody (*Ann. Rpt. Govt. Analyst [Trinidad], 1905–6, pp. 16*).—The report includes analyses of milk, a grass (*Rottboellia exaltata*) considered of some agricultural importance, banana stalks, a weed known as cane killer (*Alectra braziliensis*), water, rum, and other materials.

Van Nostrand's chemical annual, 1907, edited by J. C. Olsen (*New York: D. Van Nostrand Co., 1907, pp. X+496*).—This is the first issue of a reference book consisting for the most part of numerical data. There are in all 93 tables which give the atomic weights, physical constants of the elements, calculation of volumetric and gas analyses, specific-gravity tables, equivalents of weights and measures, etc. In addition there are classified lists of the more important articles and books which have been published since January 1, 1905.

METEOROLOGY—WATER.

The meteorological elements and their observations in their relation to weather and climate, O. Meissner (*Die meteorologischen Elemente und ihre Beobachtungen, mit Ausblicken auf Witterungskunde und Klimalehre. Leipsic and Berlin: B. G. Teubner, 1906, pp. VI+94, figs. 33; rev. in Nature [London], 75 (1907), No. 1946, p. 366*).—This is a text-book intended for higher schools and for self-instruction.

The question of the reorganization of the public weather service, Grohmann (*Mitt. Deut. Landw. Gesell., 22 (1907), No. 6, pp. 43–45*).—The weather predictions of the German weather service of particular agricultural interest are explained and their utilization briefly discussed.

Monthly Weather Review (*Mo. Weather Rev., 34 (1906), Nos. 11, pp. 505–555, figs. 15, charts 14; 12, pp. 557–607, figs. 16, charts 8*).—In addition to the usual reports on forecasts, warnings, weather and crop conditions, meteorological tables and charts for the months of November and December, 1906, progress of climatology throughout the world, recent papers bearing on meteorology, recent additions to the Weather Bureau library, etc., these numbers contain the following articles and notes:

No. 11.—Records of the Difference of Temperature Between Mount Royal and McGill College Observatory, and a Method of Local Temperature Forecasting (illus.), by C. H. McLeod; Studies on the Thermodynamics of the Atmosphere—IX, The Meteorological Conditions Associated with the Cottage City Water-

spout—Continued (illus.), by F. H. Bigelow; Climatological Reports from the Philippines; Lunar Rainbow at Tampa, Fla., by J. S. Hazen; The Origin of Our Cold Waves; Meteorology in Austria; Mountain Stations for Forecast Work; Weather Bureau Men as Educators; The Study of Practice Forecasting, by J. L. Bartlett; The Evaporation of Ice, by F. C. Mitchell; and Harmonic Analysis of the Diurnal Barometric Curve at Washington, D. C. (illus.), by W. J. Bennett.

No. 12.—Salton Sea and the Rainfall of the Southwest, by A. J. Henry (see p. 815; Changes of Latitude and Climate; Tornadoes of June 6, 1906, in Minnesota and Wisconsin; Studies on the Thermodynamics of the Atmosphere—V, The Horizontal Convection in Cyclones and Anticyclones (illus.), by F. H. Bigelow; Villard's Theory of the Aurora (illus.), by W. R. Blair; Observations of Halos in England, by M. E. T. Gheury; Problems in Meteorology (illus.), by C. F. von Herrmann; Notes on the Climate of Kansas, by T. B. Jennings; Clayden's Cloud Studies; Weather Bureau Men as Educators; and T. S. Outram, deceased.

Meteorological observations, J. E. Ostrander and T. A. Barry (*Massachusetts Sta. Met. Buls. 217, 218, pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during January and February, 1907. The data are briefly discussed in a general note on the weather of each month.

Meteorological observations at the Michigan Agricultural College for the year 1905 (*Michigan Sta. Rpt. 1906, pp. 117–130*).—Tabulated daily and monthly summaries are given of observations during 1905 on temperature, pressure, precipitation, humidity, cloudiness, wind movement, etc.

Meteorological records for 1905 (*New York State Sta. Rpt. 1905, pp. 385–391*).—Tables are given which show the average monthly precipitation since 1882; average monthly temperature since 1882; tridaily readings of the standard air thermometer during each month of 1905; a monthly summary of maximum, minimum, and standard thermometer readings; and daily readings of maximum and minimum thermometers at 5 p. m. for each month of the year.

Meteorological summary for Bern, Switzerland, for the period 1894 to 1905 (*Mitt. Bern. Statis. Bur., 1906, No. 1, pp. 77–84*).—A summary is given of observations on temperature, precipitation, and relative humidity at Zurich and Bern for the period 1894 to 1905, and summaries of observations on pressure, temperature, precipitation, and cloudiness during 1904 and 1905 at Beatenberg.

Observations at the meteorological observatory of the University of Innsbruck, 1903–4, W. Trabert (*Beobachtungen des meteorologischen Observatoriums der Universität Innsbruck in den Jahren 1903 und 1904. Innsbruck: University, 1906, pp. 133*).—Detailed data for monthly, daily, and hourly observations on pressure, temperature, humidity, precipitation, sunshine, etc., are reported in tabular form.

Meteorological observations at Verona in 1905, G. Fracastoro (*Atti e Mem. Accad. Agr. [etc.] Verona, 5. ser., 5 (1906), Sup., pp. 51*).—Observations on temperature, pressure, precipitation, humidity, direction of wind, etc., at the meteorological observatory of the Technical Institute of Verona are summarized in detail.

Influence of the ocean on climate (*Amer. Mo. Rev. of Reviews, 35 (1907), No. 3, pp. 376, 377*).—The cause and the influence on climate of the Gulf Stream and associated currents are discussed mainly on the basis of a contribution to the subject by W. Meinardus,[a] it being asserted that the Gulf Stream, which to such a large extent controls the climate of Europe, is set in motion chiefly

[a] Met. Ztschr., 22 (1905), p. 398.

by the winds that regularly blow from the west, and that these winds are themselves the result of regularly recurring low pressures in the region of Iceland. It is also explained that the more rapid this movement the stronger is the current of the cold stream which comes down along the northeast coast of North America.

The general conditions and their resultant effects are thus summarized: "A. (1) Feeble Atlantic circulation, from August to February, corresponds with (2) a low water temperature along the west coast of Europe from November to April, and with (3) a low atmospheric temperature in central Europe from February to April. (4) One result of this is bad harvests of grain in northwestern Europe. At the same time there is (5) a great diminution of ice about Newfoundland during the spring and (6) an increased amount of ice in the region of Iceland. B. (1) Strong Atlantic circulation from August to February produces (2) a high water temperature along the coast of Europe from November to April and (3) high atmospheric temperature in central Europe from February to April. One result of this again is that (4) the weather is favorable for the raising of grain and that good harvests may consequently be expected. At the same time with this condition (5) there is much drift ice during the spring in the neighborhood of Newfoundland and (6) much less ice during the same season in the region of Iceland."

Salton Sea and the rainfall of the Southwest, A. J. HENRY (*Mo. Weather Rev., 34 (1906), No. 12, pp. 557–559*).—An attempt is made in this article to show that there is no relation between the heavy rainfall of the last two years in Arizona and the Rocky Mountain States and the formation of the Salton Sea.

"The amount of vapor taken into the air over Salton Sea must be considerable in the course of a year, but to adduce definite and satisfactory proof that it has increased the rainfall is a very difficult problem. That it has increased the relative humidity in a slight measure, is undoubtedly true. Aqueous vapor in the absence of a strong wind circulation is diffused very slowly throughout the atmosphere. It is, therefore, improbable that any considerable portion of the local supply of vapor ever passes beyond the immediate confines of the desert."

Rainfall [in Bombay], P. J. MEAD (*Season and Crop Rpt. Bombay, 1905–6, pp. 1–4, I–XXII*).—Detailed data of rainfall during 1905 in the different districts of Bombay are reported and the general character of the season is discussed.

Composition of Barbados rainfall (*Rpt. Agr. Work, Imp. Dept. Agr. West Indies, 1903–1905, pts. 1–2, p. 3*).—The amount and composition of the monthly rainfall from December, 1903, to May, 1905, are tabulated. The total amount of rain falling in that period was 82.57 in., supplying approximately 239 lbs. of chlorin and 6.7 lbs. of nitrogen per acre.

Amount of chlorin in rain water, W. P. JORISSEN (*Chem. Weekbl., 3 (1906), pp. 647–649; abs. in Chem. Centbl., 1906, II, No. 20, p. 1579; Jour. Chem. Soc. [London], 92 (1907), No. 531, II, p. 48*).—The average chlorin content of 154 samples of rain water was 32.5 mg. per liter.

Amount and composition of drainage waters, rain, dew, and canal water collected during the years 1903–4, 1904–5, 1905–6, J. M. HAYMAN (*Rpt. Cawnpore [India] Agr. Sta., 1906, pp. 23–29*).—Data are given for the amount and composition of water from rain and drain gages similar to those at Rothamsted, as well as for dew collected on a surface of $\frac{1}{1000}$ acre and of irrigation water used at the station during 18 months.

The rainfall during the year ended May 31, 1905, was 49.2 in., containing 0.5 part per million or 2.44 lbs. per acre of nitrogen as ammonia and 0.3 part or

0.76 lb. per acre of nitrogen as nitrates. The drainage during the same time from bare drain gages was as follows:

The quantity and composition of drainage water.

	Percolation.	Nitrogen as ammonia.		Nitrogen as nitrates.		Total nitrogen.
		Parts per million.	Pounds per acre.	Parts per million.	Pounds per acre.	Pounds per acre.
June 1, 1904, to May 31, 1905:	*Inches.*					
Six-foot gage	21.78	0.38	0.31	7.80	106.47	106.78
Three-foot gage	22.57	.19	.31	6.20	56.71	57.01
Do	8.34	.30	.35	1.70	10.87	11.22
June 1 to October 15, 1905:						
Six-foot gage	3.14	....	....	9.40	7.40	7.40
Three-foot gage	2.93	....	....	21.73	17.85	17.85
Do	3.57	....	....	22.56	23.66	23.66

During the period September 16, 1904, to March 15, 1905, the total dewfall on a surface of $\frac{1}{1000}$ acre was 0.17 in., containing 1.85 parts per million or 0.08 lb. per acre of nitrogen as ammonia and 1.72 parts per million or 0.06 lb. per acre of nitrogen as nitrates. The irrigation water used contained on the average 0.21 part per million of nitrogen as ammonia and 0.13 part per million of nitrogen as nitrates.

Nitrogenous compounds and silica in sea water, W. E. RINGER (*Chem. Weekbl., 3 (1906), pp. 585–608; abs. in Chem. Centbl., 1906, II, No. 18, p. 1459; Jour. Chem. Soc. [London], 92 (1907), No. 531, II, p. 55*).—It is recommended that samples of sea water be examined without delay by Raben's process, as follows: Distil 100 cc. of water with a few drops of acetic acid and examine the distillate colorimetrically for nitrous acid by the phenylenediamin test. Add 1 gm. of magnesium oxid, distil off free ammonia, and determine by the Nessler test. Reduce nitrates in the residue with aluminum foil and sodium amalgam and Nesslerize the ammonia formed. Determine silica by evaporating 3 liters of the water with hydrochloric acid in a platinum dish and taking up the residue with dilute acid.

Samples of water may be preserved by adding 1 per cent of mercuric chlorid.

The drinking waters of Vermont, G. H. PERKINS (*Rpt. State Geol. Vt., 1905–6, pp. 254–342*).—Analyses of a number of samples of water, including some from Lake Champlain, are reported. The results show that Vermont is well supplied with good waters largely derived from springs.

Flowing wells and municipal water supplies of the Southern Peninsula of Michigan, F. LEVERETT ET AL. (*U. S. Geol. Survey, Water-Supply and Irrig. Papers Nos. 182, pp. XI+292, pls. 5, figs. 44; 183, pp. XIV+393, pls. 5, figs. 69*).—These bulletins record data obtained in examinations of several hundred flowing well districts and municipal and institutional water supplies in the State, and discuss the quality of the water supply of the Southern Peninsula of Michigan and the means of improving it.

The geology of Connecticut in relation to its water supply, H. E. GREGORY (*Ann. Rpt. Conn. Bd. Agr., 39 (1905), pp. 283–297*).—The sources, amount, and distribution of the river, lake, and ground waters of Connecticut are briefly discussed. It is shown that while the State is in general well watered there are few farms in it which would not give greater yields of hay and grain crops if the amount of available water were increased. It is predicted that in time irrigation will be generally practiced in Connecticut. "There is abundant water in rivers and lakes for the purpose; it needs only to be differently distributed."

Geology and underground water resources of northern Louisiana and southern Arkansas, A. C. VEATCH (*U. S. Geol. Survey. Prof. Paper No. 46, pp. 422, pls. 51, figs. 33*).—"The present report is based on the field work of the fall and winter of 1902 and 1903, supplemented by several years' field work with the Geological Survey of Louisiana and private work in eastern Texas. It covers southern Arkansas and northern Louisiana and small portions of adjacent areas in Mississippi and Texas."

The report contains six chapters, which are briefly outlined as follows:

(1) Geology, containing a discussion of the geologic history and topographic development, and including a comprehensive statement of the manner in which this portion of the coastal plain was formed and of the broader geologic facts on which the conclusions embodied in the succeeding chapters are based.

(2) General underground water conditions, containing a discussion of the fundamental principles governing underground waters and of their application to this region.

(3) Methods and cost of well making.

(4) Underground water prospects, by counties, giving well predictions and a short discussion of the underground conditions in each county.

(5) Detailed well and spring records, containing data in regard to wells, arranged in tables, by counties, with notes giving sections, etc., being, in fact, an alphabetical arrangement of all the well data collected.

(6) Dictionary of altitudes, containing a comprehensive dictionary, arranged by counties, and based on the precise levels of the United States Engineers, United States Coast and Geodetic Survey, and United States Geological Survey. To this net of precise levels the railroad levels have been connected and the corrections determined.

Geology and underground waters of the Arkansas Valley in eastern Colorado, N. H. DARTON (*U. S. Geol. Survey, Prof. Paper No. 52, pp. 90, pls. 28, figs. 2*).—This report deals briefly with the general geology of eastern Colorado and in detail with the geology and underground waters of the Arkansas Valley region.

The principal water-bearing formation of this region is the "Dakota" sandstone, but waters also occur extensively in the alluvial deposits along the valleys, in the sands and gravels mantling parts of the upland east of the mountains, and in the sandstones of the Fox Hills, Laramie, and overlying formations. Smaller amounts, mostly of bad quality, occur in the "Red Beds."

The quantity of water available from the "Dakota" sandstone in eastern Colorado is variable, and in portions of the region has been found inadequate. As a rule the pressure is too low to sustain a vigorous flow. The largest volume of water has been obtained from wells at Rockyford. In some districts the quality of the water is satisfactory, in others the waters are highly charged with minerals.

The bacterial examination of water supplies, W. G. SAVAGE (*London: H. K. Lewis, 1906, pp. XVI+297, figs. 13*).—The author of this treatise states his purpose to be to present "a book dealing, not merely with the details of practical procedure, but also with the data upon which these methods are based, and with the deductions held to be justifiable from them. . . . Dogmatic opinion has been avoided, the subject being considered from a critical standpoint, and practical conclusions drawn only when they seem justified by the available evidence."

With the advantage of a rather wide experience in the practical work of examining water supplies, he has succeeded in bringing into ordered relationship within the limits of one compact volume the more important of the large amount

of data on the subject of water examination which have accumulated during comparatively recent years.

Different chapters treat of the influences affecting bacteria in water; the quantitative bacterial content of natural waters; bacteriology of excreta, sewage, and soil in relation to bacteriological examination of water; *Bacillus coli*, *B. enteritidis sporogenes*, Streptococci, and allied organisms of water; bacterial indicators of pollution; interpretation of results of bacteriological examination of water; classification of water bacteria; collection and transmission of samples; methods for the enumeration and identification of *B. coli* and allied organisms; and examination of water for the typhoid bacillus and other intestinal organisms.

An appendix gives a summary of procedure for routine examination and describes and explains the use of a number of indicators. A bibliography of 239 references to the recent literature of the subject is also given.

SOILS—FERTILIZERS.

Soil studies, I, A. W. Blair (*Florida Sta. Bul. 87, pp. 15–46, figs. 2*).—Information regarding the soils of Florida is summarized mainly from publications of the Bureau of Soils of this Department and of the Florida Experiment Station. The principal facts brought out are briefly stated as follows:

"(1) Most Florida soils are very deficient in plant food, and also in those materials which, in clay soils, absorb or hold for the future use of the plant the food that is applied in the form of fertilizers.

"(2) On account of the almost entire absence of these binding materials, the loss of soluble fertilizers, by leaching, is very great; the loss from this cause on the pineapple fields of the east coast being apparently over 60 per cent of the amount applied.

"(3) These same Florida soils, however, under careful cultivation and liberal fertilizing produce abundant crops of the fruits, vegetables, and grains that are adapted to this climate.

"(4) In order, therefore, that his operations may be profitable, it is incumbent upon the Florida farmer and fruit grower to pursue such methods of cultivation and fertilizer application as will, so far as possible, prevent this loss."

The rotation of crops supplemented by application of fertilizers in order to maintain the balance of fertility is explained, as well as the use of lime, windbreaks, shading, barnyard manure and green manures, etc., to improve the chemical and physical properties of the soils.

Soils, B. C. Aston (*New Zeal. Dept. Agr. Ann. Rpt., 14 (1906), pp. 105–108*).—Analyses with reference to volatile matter, total nitrogen, and available (by Dyer's method) potash and phosphoric acid of 25 samples of soils from different parts of New Zealand are reported with notes on acidity and other characteristics of the soils. A plea is also made for the organization of a soil survey similar to that conducted by this Department.

The soils of the Muganj steppe and their transformation into alkali lands by irrigation, N. Tulaykov and P. Kossovich (*Izv. Moscov. Selsk. Khoz. Inst. (Ann. Inst. Agron. Moscou), 12 (1906), No. 2, pp. 27–255, pls. 7, figs. 6, map 1*).—This is the detailed report of work of which a review by S. Sacharov was noted in E. S. R., 18, p. 426. The investigations reported were made in 1905 under the auspices of the Russian government, with a view to finding means of preventing further formation of alkali soils in the region named.

The investigations show that the soils of the region are generally poor in humus (1 to 2 per cent) and nitrogen, but rich in soluble and zeolitic substances,

calcium and magnesium carbonates, phosphoric acid (0.1 to 0.25 per cent), and potash (0.4 to 0.6 per cent). The soils vary mainly in texture and structure, these variations causing them to differ widely in their behavior toward alkali under irrigation.

Flooding is the common method of irrigation employed. A study of the effect of flooding upon the movement of alkali in soils of different physical properties led to the following conclusions: (1) Flooding of the heavy, fine-grained soils may be practiced for a long time without danger of rise of alkali, but the amount of water used should be sufficient to thoroughly saturate the whole area, and the soil should be cultivated and planted as soon as the condition of the surface soil permits. (2) To avoid rise of alkali in flooding light sandy soils the water must be supplied in abundance and rapidly and irrigation must be confined to small areas at a time. Measures must also be taken to decrease the loss of water through evaporation. (3) Thorough drainage is necessary to prevent rise of alkali in the soils of this region under irrigation.

What processes go on in fallow soils? ULRICH (*Fühling's Landw. Ztg., 55 (1906), No. 6, pp. 200–215; abs. in Centbl. Bakt.* [etc.], *2. Abt., 17 (1906), No. 17–18, p. 572*).—The active physical, chemical, and bacteriological processes which go on in fallow soils are discussed.

Effects of shading on soil conditions, J. B. STEWART (*U. S. Dept. Agr., Bur. Soils Bul. 39, pp. 19, pls. 4, figs. 7*).—This bulletin reports the results of observations on temperature, soil moisture, humidity of the air, and wind movement inside and outside of a shelter tent for tobacco during the period from June 13 to August 1, 1905, and the results are discussed with reference to the influence of the conditions inside the tent on the growth of tobacco. The studies are of the same general nature as those recently reported by the Pennsylvania Station (E. S. R., 18, p. 211). The main results are summarized in the following table:

Temperature, soil moisture, and relative humidity, inside and outside of tent.

Observations.	Average soil moisture for season.	Average temperature for season.	Average relative humidity for season.
	Per cent.	*Degrees F.*	*Per cent.*
Inside of tent	14.7	72.8	79.0
Outside of tent	11.6	71.4	71.7
Difference	3.1	1.4	7.3

The following conclusions are drawn:

"(1) The soil retains more moisture, which is of especial importance during the dry periods. The inside soil is then always closer to the optimum water content. Because the soil is not subject to the packing due to alternate wetting and drying, it remains in better physical condition.

"(2) The temperature of the atmosphere is made slightly warmer, which brings the temperature closer to the optimum growing temperature. An even greater effect is, however, perhaps due to the fact that there is less variation in the temperature, which is generally recognized to be of much importance.

"(3) The relative humidity of the atmosphere is greatly increased. In addition to its effect on soil and atmospheric conditions it has an influence on plant growth. . . .

"(4) The velocity of the wind is much reduced, which decreases evaporation, and is of importance in the preservation of the plants, for they are not whipped, bruised, or blown down.

"(5) The plants make a larger, more rapid, and earlier growth. These are the results that induce and make it profitable for the tiller of the soil to go to the expense of erecting the tent."

Studies on the movement of soil moisture, E. Buckingham and F. K. Cameron (*U. S. Dept. Agr., Bur. Soils Bul. 38, pp. 61, figs. 23*).—The studies reported in this bulletin dealt with the loss of soil moisture by direct evaporation from points below the surface, especially as related to the drying of soils under arid and humid conditions, and with a general examination of the theory of capillary action in soils. The measurements of evaporation were made with soils in tumblers or small cylinders under varying conditions of moisture content, compactness, or surface tilth. The examination of the theory of capillary action in the soil was based upon curves representing the distribution by capillarity of moisture in soil in tubes under different conditions of tilth, etc.

The results in general show that, contrary to the general belief, "the loss of water by evaporation from points below the surface, while it does take place in measurable quantities, is nevertheless quite small, and is negligible in comparison with the losses taking place at or very near the surface. The movement of water vapor through the soil is shown to follow the law governing the diffusion of other gases through porous media, and is quite slow. Mulching decreases or inhibits the capillary flow, and diffusion through the mulch is practically negligible. This practice is very effective in conserving soil moisture, and is founded on sound scientific principles. An especially interesting illustration is brought out in the comparison of the loss of water from a soil under arid and humid conditions, respectively. As might be expected, the loss at first is much more rapid under the arid conditions, so rapid in fact as to overtax the soil's ability to move water from within to the surface by capillarity, and in consequence a dry layer or mulch is formed which keeps the subsequent losses far below those which take place from the soil under humid conditions, where the capillary flow to the surface persists until the moisture content of the whole soil is very low indeed. These laboratory experiments, therefore, clear up in a very satisfactory manner the well-known and apparently contradictory facts observed in the field that the soils of arid regions, at depths a little below the surface, are generally wetter and hold their moisture for much longer periods than do the soils of humid areas in dry seasons.

"An examination of the curves representing the distribution of moisture in the soil has suggested that, if the subject be regarded from the standpoint of dynamical equilibria phenomena, there appear certain analogies to the theory of electrical and thermal potential. This is a fact of great importance in the theoretical study of the subject, since we are in possession of a well-developed theory of electrical and thermal potential which can be applied to a considerable extent to the phenomena of soil moisture; it is of probable practical value, because it suggests and gives direction to further experiments and serves as a basis for the correlation of a large number of observations already made, but having hitherto a local rather than a general value.

"It is clearly recognized that the analogy is imperfect in that the capillary potential and resistance to flow are dependent upon the moisture content of the soil, whereas electrical and thermal resistance are practically independent of the amount of current and heat passing."

Quality of commercial cultures for legumes in 1906, M. J. Prucha and H. A. Harding (*New York State Sta. Bul. 282, pp. 269–279*).—This bulletin reviews the results of experiments by 16 experiment stations in the United States during 1904–5 and reports a continuation of tests of commercial cultures during 1906 at the New York State Station. It is stated that the tests made by

the 16 stations have shown the commercial culture of legume bacteria dried on cotton to be of little or no practical value. The tests made by the New York State Station indicate that the metal containers which have recently been used for protecting the commercial cultures from deterioration are not effective for that purpose.

"The results from the examinations of 20 commercial cultures indicate that the goods upon the market for 1906 were little if any better than those offered in 1905. In neither year was there any evidence that the purchaser had had more than the remotest chance of receiving the worth of his money from the use of such cultures."

Dried cultures for legumes unsatisfactory, F. H. HALL ET AL. (*New York State Sta. Bul. 282, popular ed., pp. 4*).—A popular edition of the above.

Principles and maintenance of soil fertility, A. R. WHITSON and C. W. STODDART (*Wisconsin Sta. Bul. 139, pp. 28, figs. 9*).—"This bulletin is written for the purpose of putting before the farmer a statement of our present knowledge of the factors which influence the fertility of the soil and of the relation of these factors to each other."

The following topics are discussed mainly on the basis of experimental results obtained at the Wisconsin Station: Chemical composition of soils; conditions which influence fertility, such as amount and condition of organic and inorganic matter, nitrification, nitrogen fixation, and acidity; and the nature and use of fertilizers of various kinds.

Analyses and valuations of commercial fertilizers and ground bone, J. P. STREET, V. J. CARBERRY, and P. E. BROWN (*New Jersey Stas. Bul. 198, pp. 30*).—This is the final report on fertilizer inspection for the year 1906 (for previous report see E. S. R., 18, p. 433), and discusses the results of inspection for the year as a whole. Of the 635 samples of fertilizers and fertilizing materials examined during the year, 430 were complete fertilizers. The average composition of the complete fertilizers was about the same as during the previous year except in the case of potash, which showed a considerable decrease. A comparison of average prices shows that the manufacturers furnished on the average during 1906 a little less plant food than in 1905 at a correspondingly reduced price per ton.

"The same apparently wide difference of opinion among manufacturers as to the requirements of special crops is quite as noticeable as in previous years. This year there are 123 different brands designated for potatoes with 55 different guarantees, 77 for vegetables and truck with 48 different guarantees, 32 for corn with 23 different guarantees, and 23 for sweet potatoes with 13 different guarantees. The guarantees in brands designated for these different crops differ quite as widely as noted in previous years; with the possible exceptions of the formula 2:8:10 for white potatoes and the same formula for sweet potatoes, there is little agreement among the manufacturers as to the crops' requirements. These wide variations in guarantee emphasize very strongly how little useful information is supplied by the name of a brand as regards its use for any special crop."

Commercial fertilizers, T. L. CALVERT and N. W. LORD (*Offic. Rpt. Sec. Ohio Bd. Agr. on Com. Ferts., 1906, pp. 94*).—This is a report of inspection of fertilizers licensed for sale in Ohio during 1906, giving guarantees and actual analyses of 615 samples.

Some facts concerning fertilizers and their use, R. HARCOURT (*Ontario Dept. Agr. Bul. 153, pp. 16*).—This is a compilation of information on the nature and use of fertilizers, including simple directions for making fertilizer experiments.

Powdered granite as fertilizer (*Amer. Fert., 26 (1907), No. 1, p. 9*).—Recent work on this subject by this Department and earlier experiments by Maerker are briefly discussed.

Value of ant hills as a fertilizer, T. CHURCH (*Jour. Dept. Agr. West. Aust., 14 (1906), No. 5, pp. 392, 393*).—Analyses are reported which show this material to be of very fine texture, all passing a sieve with meshes 2 mm. in diameter and of acid reaction. The phosphoric acid in the two samples examined was 0.02 and 0.03 per cent, respectively, potash 0.06 per cent in each case, lime 0.1 and 0.07 per cent, respectively, and nitrogen 0.15 and 0.18 per cent, respectively. Very small proportions of the phosphoric acid (0.008 and 0.005 per cent) and potash (0.02 and 0.01 per cent) were available. Experiments with the soil with different crops indicated that it was somewhat more fertile than soil surrounding the ant hills.

Origin, occurrence, and chemical composition of peat, W. E. MCCOURT (*Sci. Amer. Sup., 63 (1907), No. 1622, pp. 25994, 25995*).—In this article, abstracted from the annual report of the State geologist of New Jersey, analyses of peat of various kinds are compiled from different sources and the characteristics of the different kinds of peat are described.

The technology and uses of peat, C. W. PARMELEE (*Ann. Rpt. State Geol. N. J., 1905, pp. 232–256; Sci. Amer. Sup., 63 (1907), Nos. 1626, pp. 26046, 26047; 1627, pp. 26062, 26063; 1628, pp. 26086, 26087*).—This is one of a series of articles on this subject and deals especially with the uses of peat as fuel, in agriculture as a filler for fertilizers and as litter and in composts, for manufacture of textiles as absorbent, non-conductor of heat and sound, as a preservative, etc.

On the fertilizing value of the residue obtained from the retting of hemp, G. A. CALABRESI (*Staz. Sper. Agr. Ital., 39 (1906), No. 6–7, pp. 618–622*).—Analyses with reference to fertilizing constituents are reported of 3 samples of this material in the wet, air-dry, and dry (at 100° C.) condition. In these analyses the percentage of moisture varies from 49.3 to 54, of nitrogen from 0.23 to 0.55, of phosphoric acid from 0.17 to 0.24, and of potash from 0.26 to 0.35. In the air-dried material the moisture varies from 10.2 to 14.1 per cent and the percentages of the other constituents increase in proportion.

Hoof meal (*Amer. Fert., 26 (1907), No. 1, pp. 10, 11*).—The methods employed by packers in preparing this material for use as a fertilizer are briefly described.

On manures and fertilizer trials, M. WEIBULL (*Fyra Uppsatser i Växtkultur. Gothenburg, 1906, pp. 45–69*).—This is one of four articles published in the pamphlet quoted on the occasion of the twentieth general Swedish agricultural convention at Norrköping in 1906.

The story of soils and plants in their relation to liming, H. J. WHEELER (*Ann. Rpt. Conn. Bd. Agr., 39 (1905), pp. 74–103, figs. 15*).—A rather complete review of the more practical results of investigations relating to the use of lime in agriculture.

The need of liming for heavy marsh soils, CLAUSEN (*Illus. Landw. Ztg., 27 (1907), No. 9, pp. 63, 64*).—This article briefly reports experiments which show the beneficial effects on such soils of liming and marling. The comparative economy of the two materials is discussed, but no definite conclusion is reached on this point.

Use of different forms of lime (*Jour. Bd. Agr. [London], 13 (1907), No. 10, pp. 621–623*).—Comparative tests by the agricultural department of the Lancashire County Council of coarse quicklime (cob lime), ground lime, and ground limestone on meadow land are reported. The results in general indicate that the more finely divided forms of lime are more immediately effective than

coarser quicklime and also that ground limestone is a more profitable dressing than either ground lime or coarse quicklime.

Investigations on the action of lime nitrogen on various kinds of soil, T. REMY (*Landw. Jahrb., 35 (1906), Sup. 4, pp. 114–133, pls. 2; abs. in Deut. Landw. Presse, 34 (1907), No. 6, p. 40*).—A series of pot experiments on the utilization of the nitrogen of this material, its injurious action on the growth of plants, and its effect on the bacterial life of the soil is reported, from which the following conclusions are drawn:

The efficiency of this source of nitrogen depends largely upon the character of the soil upon which it is used. It is most efficient on clayey soils, being in this case but little inferior to nitrate of soda. On such soils injurious effects are not observed even when the material is applied in comparatively large amounts. Much less favorable results, however, were obtained on sandy soils. In this case the utilization of the nitrogen was much less complete and rapid than on heavy soils, comparing in these respects more nearly with blood meal. Even in amounts not exceeding the usual applications of such materials the lime nitrogen showed an injurious effect on germination and growth of plants on such soils. The injurious effect was especially marked in the case of the nitrogen-collecting bacteria (Azotobacter) of the soil. The length of time through which the injurious effect will continue was not definitely determined. In the experiments reported by the author the effect on germination had entirely disappeared at the end of 3 months. The results indicate in general that lime nitrogen should be used with caution on light soils.

Some experiments on the action of lime nitrogen and nitrogen lime on cultivated plants, F. MACH (*Fühling's Landw. Ztg., 55 (1906), No. 24, pp. 830–847*).—Pot experiments extending over 4 years to test the relative fertilizing value of these materials are reported with barley, mustard, carrots, and buckwheat.

The "nitrogen lime" used was that prepared by the Polzenius process of fixing free nitrogen by passing it over a heated mixture of calcium carbid and calcium chlorid. It contained about 22 per cent of nitrogen, while the lime nitrogen with which it was compared contained about 18 per cent of nitrogen.

The results showed in general that the two fertilizers were about equally effective and that the nitrogen was equally well utilized by the crop in each case. As a rule no appreciable injurious effect was observed from either source.

Experiments with nitrogen lime, B. HARDT (*Deut. Landw. Presse, 34 (1907), No. 5, pp. 29, 30*).—Cooperative tests by farmers under different conditions of soil, cropping, etc., are briefly reported.

The results were in general favorable to the use of the material as a fertilizer, especially when applied some time before planting of the crop and thoroughly incorporated with the soil. It gave good results on sandy soils when these were not acid. On old cultivated lands it gave best results when the soil had previously been well fertilized with barnyard manure. Moor soils should be well limed before the application of this material.

Nitrate of soda statistics (*Saaten, Dünger u. Futtermarkt, 1907, No. 3, p. 77*).—Statistics of production and consumption of this material from 1897 to 1906 are summarized. The world's consumption during 1906 is given as 1,639,300 tons, of which 1,241,400 tons was used in Europe and 361,900 tons in the United States.

Wholesale manufacture of nitrate fertilizer, C. M. PEPPER (*Daily Consular and Trade Rpts.* [*U. S.*], *1907, No. 2766, pp. 3, 4*).—A brief note is given referring to the prospective utilization of the Jhelum River in Kashmir, India, in the manufacture of lime niter for fertilizing purposes by the Norwegian

process. The conditions are said to be unusually favorable to such a project, namely, abundant water power and unlimited limestone near at hand. It is also close to the Punjab, the great grain-growing region of India, which is in great need of a cheap nitrogenous fertilizer.

Comparative fertilizer tests of Thomas slag and agricultural phosphate, L. PECHMANN and CLAUSEN (*Fühling's Landw. Ztg., 55 (1906), No. 24, pp. 855–857; Deut. Landw. Presse, 34 (1907), No. 3, p. 17*).—The results of experiments by different investigators are briefly summarized.

On the stability of Thomas-ammonium-phosphate lime, M. SCHMOEGER and L. VON WISSELL (*Fühling's Landw. Ztg., 56 (1907), No. 1, pp. 1–6*).—The authors found that this material as prepared by the usual process of mixing Thomas slag, ammonium sulphate, and lime waste from beet-sugar factories loses a considerable amount of its nitrogen in a comparatively short time. By adding about 5 per cent of calcium chlorid or 3 per cent of dried carnallite, this loss was entirely prevented.

Comparative fertilizer tests with Thomas slag and agricultural phosphate, BACHMANN (*Mitt. Deut. Landw. Gesell., 21 (1906), No. 51, pp. 483–485*).—Replying to a previous article by Clausen (E. S. R., 18, p. 620), the author presents further data to show that under proper conditions agricultural phosphate is a very effective fertilizer. The principal of these conditions are good mechanical condition of the soil, a sufficient supply of humus, and thorough distribution of the phosphate in the soil. The use of barnyard manure with the phosphate also increases its effectiveness, and conditions which promote the growth of bacterial flora in the soil favor assimilation of the phosphate.

Comparative fertilizer tests of agricultural phosphate and Thomas slag, CLAUSEN (*Mitt. Deut. Landw. Gesell., 22 (1907), No. 4, pp. 26–28*).—A reply to an article by Bachmann already noted (E. S. R., 18, p. 621), in which the author maintains that the use of ammonium sulphate in connection with Thomas slag and agricultural phosphate results in an over valuation of the phosphoric acid in the agricultural phosphate and under valuation of that in Thomas slag.

AGRICULTURAL BOTANY.

Distribution and adaptation of the vegetation of Texas, W. L. BRAY (*Bul. Univ. Texas, Sci. Ser. No. 10, pp. 112, pls. 14, figs. 4*).—This bulletin was prepared by the author with the desire of presenting to teachers a point of view from which to study the vegetation of the State, which is not supplied by present publications. In the bulletin the vegetation of Texas is considered as a whole from the standpoint of its relation to environment. The various factors of plant environment and how they affect plants are described, consideration being given to water, temperature, light, atmosphere, and edaphic and biological factors. After discussing the environmental factors, the author describes the various plant societies which he recognizes as occurring in the Texas region.

The relation between the osmotic strength of cell sap in plants and their physical environment, E. and HILDA DRABBLE (*Bio-Chem. Jour., 2 (1907), No. 3, pp. 117–132*).—In a previous publication the authors gave a preliminary statement regarding the osmotic strength of sap in plants growing under different conditions (E. S. R., 18, p. 127). Their investigations have been continued, so that 48 plants have been studied from quite a range of environment, including bogs, gardens, woods, moorland and mountains, sand dunes, brackish water, and salt marshes, and the relation between environment and strength of the cell sap in the different plants has been clearly established.

The authors in summarizing their investigations show that the osmotic strength of cell sap is least in submerged fresh-water plants and greatest in

salt-marsh plants. The greater the physiological drought under which the plants are accustomed to grow the greater will be the osmotic strength of the sap in the turgid cell. For any locality the osmotic strength will vary with the physiological scarcity of water. In all plants growing under the same conditions the osmotic strength of the cell sap is practically the same. Where marked differences in structural arrangements for checking loss of water by transpiration are present the plants with the less adequate anatomical provision for transpiration will have the greater strength of cell sap. The effect of increasing the osmotic strength of sap on absorption is very marked, the rate of absorption of water being proportional to the osmotic strength of the sap. The effect of increased temperature is also quite appreciable and tends to enhance the power of absorption of water by plants.

On the transpiration current in plants, H. H. Dixon (*Proc. Roy. Soc. [London], Ser. B, 79 (1907), No. B 528, pp. 41–57, figs. 5*).—The author criticises a paper by Ewart (E. S. R., 17, p. 958), pointing out objections to the methods of investigation presented, and in addition he gives further arguments affirming the cohesion theory of Dixon and Joly regarding the transpiration current in plants (E. S. R., 7, p. 560).

The effects of magnesium sulphate upon seedlings, Gertrude Burlingham (*Abs. in Science, n. ser., 25 (1907), No. 638, p. 452*).—A report is given of extended experiments to test the effect of dilute solutions of magnesium sulphate on seedlings. It was found that while magnesium sulphate is usually toxic in strengths greater than 0.003 per cent, in weaker solutions it produces a decided stimulating effect, reaching a maximum in dilutions of 0.00075 to 0.00018 per cent. Beyond this point the action gradually diminishes.

Seedlings allowed to grow for several weeks in a dilute solution of magnesium sulphate which was at first slightly toxic, finally developed strong lateral roots and attained a root growth far beyond the controls. This seems to show that magnesium sulphate in proper dilution is beneficial to the growth of seedlings, and that any inhibitory effects are due to the presence of excessive amounts, thus controverting Loew's theory that magnesium salts when alone in solution are always injurious to plant growth.

The effects of salts of some rare elements on seedlings, Alice A. Knox and W. H. Welker (*Abs. in Science, n. ser., 25 (1907), No. 638, p. 461*).—Salts of a number of rare elements were tested on seedlings. The greatest molecular concentration points at which growth occurred during the first 24 hours were noted, as well as the least growth. It was found that the increase in toxicity followed Mendeléef's table almost mathematically, the toxicity increasing from group to group with the increase in molecular weight.

The physiological resistance of saline plants to the action of sea salt, A. Casu (*Ann. Bot. [Rome], 5 (1907), No. 2, pp. 273–354, figs. 2*).—A study was made of the flora of Cagliari to ascertain some of the factors which determine the distribution of plants in soils that are more or less impregnated with salt. After an extended review of literature, the author gives in detail the results of his investigation on the physical, chemical, and physiological effect of various salts on the germination and growth of the strand flora, comparing the results obtained in his experiments with the spontaneous occurrence of plants in the regions studied.

Observations on the effects of the rays of radium on plants, C. S. Gager (*Abs. in Science, n. ser., 25 (1907), No. 638, p. 462*).—It has been shown that the rays of radium and other radioactive substances act as a stimulus to germination and growth, and further experiments by the author warrant a similar conclusion with respect to other plant activities, such as respiration, starch

making, geotropic response, etc. The growth of plants watered with radioactive water may be accelerated or retarded, the results varying not only with the degree of radioactivity but also with the species of plant employed. When pollen or ovules were exposed before pollination, or when exposure was made after fertilization of the egg, plants growing from the resulting seeds were found to vary profoundly from the parent plants. Whether these variations are capable of transmission is yet to be determined.

Composition of cocoanut water and presence of diastases in cocoanuts, E. DE KRUIJFF (*Bul. Dept. Agr. Indes Néerland., 1906, No. 4, pp. 1–8*).—In the course of a study to determine the industrial value of the so-called milk or water of the cocoanut, the author investigated its composition and also the occurrence of diastases. It was found that the cocoanuts contained saccharose, which is inverted during the maturity of the nut by a diastase secreted by the cells of the endosperm. In addition to sucrose the author reports the presence of oxydase and catalase, the two latter not being present in the immature fruit. The haustorium was found to contain in addition to these diastases lipase, amylase, catalase, and peroxydase.

The rôle of phenols, tannic acids, and oxybenzoic acids in cork formation, E. DRABBLE and M. NIERENSTEIN (*Bio-Chem. Jour., 2 (1907), No. 3, pp. 96–102, pl. 1*).—According to the authors, it is generally believed that tannins and other aromatic compounds play an important part in the lignification of wood elements, and that when tannins, phenols, and oxybenzoic acids are treated with formaldehyde and a little hydrochloric acid, condensation products are precipitated. This suggests that in the formation of cork similar condensation products probably play an important part.

The authors made an examination of a number of living plants to trace the distribution of tannic acid, phenols, etc., in the stems, and in every case where cork was found a coloration of the cells in the immediate vicinity was shown, indicating the presence of gallic or tannic acid. In the plants which gave no reaction no cork was present.

The authors are led to attribute to tannic acids, phenols, gallic acid, and other oxybenzoic acids an important rôle in the formation of cork. The presence of substances of this class was clearly shown wherever cork tissue was found. The substances giving cork reactions are precipitated from tannic acids, phenols, and oxybenzoic acids by means of formaldehyde in the presence of various acids, and products having the same mother substance as these condensation products have been obtained from the cork itself. The authors believe that tannic and gallic acids and substances of this nature are acted upon in the plant by formaldehyde and various acids and are precipitated on the walls of the cork cells.

Hydrocyanic acid glucosids and hydrocyanic acid in plants, A. EICHINGER (*Pharm. Ztg., 52 (1907), No. 15, pp. 146, 147*).—A résumé is given of considerable of the literature relating to the occurrence in plants of glucosids that under the influence of enzyms split up into hydrocyanic acid. The occurrence of these glucosids in a number of species of plants is mentioned, and the localization, source, and function of hydrocyanic acid are discussed.

On the poisons of Amanita phalloides, J. J. ABEL and W. W. FORD (*Jour. Biol. Chem., 2 (1907), No. 4, pp. 273–288*).—It has been shown by one of the authors that the poisons of the fungus *Amanita phalloides* belong to the group of bacterial toxins, and further that the principle described by Kobert under the name of phallin as the only poison present is accompanied by a highly toxic substance devoid of hæmolytic properties. The presence of this substance can be demonstrated by biological experiments.

The authors state that immunity can be established toward the two poisonous

principles of *A. phalloides* and that the serum of immunized animals is antihaemolytic and antitoxic in character.

The haemolytic principle contained in Amanita and first detected by Kobert is not a toxalbumin, as was supposed, but a nitrogenous glucosid which is very sensitive toward the action of heat and acids and easily decomposed by acids so as to yield a pentose and some volatile base or bases, such as ammonia and methylamin. This glucosid the authors have designated as Amanita-haemolysin. Its properties are said to be such as to preclude it from playing any rôle as a blood poison in the case of poisoning by these mushrooms.

The influence of mushrooms on the growth of some plants, G. F. Atkinson (*New York Cornell Sta. Bul. 240, pp. 217–234, figs. 11*).—The author carried on an investigation to determine whether the substance of various fleshy fungi could be used as food to any extent by green plants in either an undecomposed condition, or when partly or completely decomposed by bacteria or fungi.

In the spring of 1905 some preliminary experiments were conducted with the common mushroom (*Agaricus campestris*) as a source of plant food for corn, beans, peas, and buckwheat. In the winter and spring of 1906 these experiments were repeated with better control. The plants were grown in quartz sand, and the mushroom material was used fresh in an unfermented condition in some of the pots, while in others it was fermented. Wheat, buckwheat, corn, sunflower, and radishes were planted in the different pots. It was found that the stronger fermented substance produced the richest color and tallest plants, followed by the weaker strength of fermented material, while the check plants were the smallest and the poorest in color. An examination of photographs taken of the growing plants showed a constancy in the curve of growth for the different kinds of plants corresponding to the nature of the material supplied.

Experiments were also carried on with pure cultures with agar-agar as a substratum, and the results were in the main comparable with those described above.

The author states in conclusion that the experiments show that a portion of the substance of the common mushroom and probably of all the Basidiomycetes may become available as food for autotrophic green plants, and that the decomposition products of heterotrophic plants form a nearly perfect food for autotrophic ones.

The properties of culture media as affected by certain products of plant metabolism, O. Schreiner and J. F. Breazeale (*Abs. in Science, n. ser., 25 (1907), No. 638, p. 454*).—It is claimed that certain products of plant metabolism, such as degradation products of proteids and lecithins, are harmful to seedling plants. Some of these products found in green plants lose their toxic properties on oxidation and become beneficial. It is pointed out that this explains the advantage of green manuring over mineral fertilizers.

On the chemical action of spores, J. Effront (*Monit. Sci., 4. ser., 21 (1907), No. 782, pp. 81–87*).—While studying the oxidation of albuminoids the author found that albumin coagulated at 110° C. and kept in a humid sterile atmosphere finally showed pronounced enzymic characters. An investigation of the occurrence of enzyms in sterile media and the chemical action of dead cells led him to decide that the appearance of enzyms in sterile media is due to the presence of bacterial spores which still retain their secreting power although their ability to germinate has been destroyed.

A study of the spores of *Bacillus subtilis* confirmed this conclusion. It is claimed that spores of bacteria retain their property of producing enzyms after their vitality has been destroyed by heat or otherwise. The spores of *B. subtilis* were found capable of producing large quantities of amylase and peptase. The production of enzyms by bacterial spores increases as the possibility of their

development diminishes, reaching a maximum at the time when absolute sterility is attained. The chemical changes which take place in milk, wine, beer, etc., after sterilization are to be attributed in part at least to the results of arrested spore development. The author says that the liquefying and saccharifying action which is acquired by albumin under the influence of metallic acids is to be explained by the constant presence of spores of *B. subtilis* in the albumin and not, as has been repeatedly claimed, by the appearance of artificial diastases.

FIELD CROPS.

Results obtained in 1906 from trial plats of grain, fodder corn, field roots, and potatoes, W. and C. E. SAUNDERS (*Canada Cent. Expt. Farm. Bul. 55, pp. 35*).—The results secured in 1906 in variety tests conducted at the Canada experimental farms with the different field crops are given in tabular form with brief general notes. The reports of earlier years have been previously noted (E. S. R., 17, p. 961).

The testing of different varieties on uniform trial plats has now been in progress for 12 years, but this bulletin departs from previous reports in omitting the averages of the returns from all the experimental farms. The tables are so arranged as to show the varieties in the order of their average yield for the last 5 years.

Is the protein content of barley a variety characteristic? H. TEDIN (*Sveriges Utsädesför. Tidskr., 16 (1906), No. 4, pp. 177–187*).—The results of protein determinations in Swedish malting barley secured from 1899 to 1904 showed variations ranging generally from 2 to 4 per cent in all the varieties analyzed. Some samples of each variety tested were found to contain over 11 per cent of protein. The maximum content, 15.14 per cent, was obtained in a sample of Svanehals, and the minimum, 7.23 per cent, in a sample of Princess. On an average Princess contained about 1 per cent less protein than Chevalier.

The author concludes that the variety is of minor importance in determining the protein content of barley, and that this factor depends mainly upon conditions of culture and growth.—F. W. WOLL.

Corn culture, R. J. REDDING and J. M. KIMBROUGH (*Georgia Sta. Bul. 74, pp. 195–208*).—The 10 varieties compared during the season of 1906 gave an average yield of 25.13 bu., Marlboro Prolific and Cocke Prolific leading with 28.60 and 28.50 bu. per acre, respectively. Marlboro stood second in 1905. Hastings' Prolific, which made the smallest ears, ranked sixth this year, while Marlboro, which gave the third smallest ears, stood first. Henry Grady, making the largest ears, ranked fifth in the total yield of shelled corn per acre. From these results it appears "that there seems to be no very significant relation between the total yield and the size of the ears."

A comparison of cotton-seed meal and crushed cotton seed as a fertilizer for corn resulted in a yield of 24.56 bu. per acre on the cotton-seed meal plats and of 22.05 bu. on the crushed cotton-seed plats. Cotton-seed hulls were found not only ineffective as a means of increasing the yield of corn in the current year, but even actually reduced it. This material is considered too valuable as cattle feed to be used as a fertilizer. As in former years dividing the applications either of cotton-seed meal or nitrate of soda, applying one-half before planting and the rest as late as either May 1 or May 20 was found inexpedient.

Brief notes on corn culture based on the results secured in 17 years of experiments conclude the bulletin.

Williamson method of corn culture, J. F. DUGGAR and L. N. DUNCAN (*Alabama Col. Sta. Bul. 138, pp. 102–106, figs. 2*).—A comparison is reported of the Williamson and ordinary methods of growing corn. A plat was devoted to each

method and the treatment was identical except in the points which distinguish the Williamson method.

The yield of shelled corn was 30.5 bu. per acre on the Williamson plat and 29.5 bu. on the check plat. On the Williamson plat each plant averaged 0.346 lb. of shelled corn and on the other 0.667 lb. The average weight of ear on the check plat was 0.54 lb. as compared with 0.45 lb. on the Williamson plat. One hundred plants grown by the Williamson method produced 96 ears and nubbins as compared with 156 ears and nubbins in the check test. The average height from the ground at which the ears grew on the check plat was 44½ in. and on the Williamson plat 36¼ in. The Williamson plat showed 29 per cent of broken stalks while the check plat showed only 14 per cent.

Applications of 200 lbs. cotton-seed meal, 200 lbs. acid phosphate, 400 lbs. kainit, and 200 lbs. nitrate of soda per acre were used, but the yield was not sufficient to make the use of such large quantities of fertilizers profitable. It is believed that the proportion of kainit in the Williamson fertilizer is too high.

It is also suggested that the unusually large yields obtained by this method on upland in South Carolina may be due more to the frequent plowing under of a crop of cowpea vines, to the liberal use of nitrogenous fertilizers, and to close planting than to the dwarfing of the plants through omission of cultivation and withholding until late the application of fertilizers.

Variety tests with cotton and corn, J. F. Duggar and L. N. Duncan (*Alabama Col. Sta. Bul. 138, pp. 97–102*).—Of 32 varieties of cotton under test Toole, Cook Improved, Cleveland, Bancroft, Herlong, and Christopher ranked first in 1905, and of 20 varieties compared Cook Improved, Cleveland, Layton, Toole, and Pullnot were the leaders in 1906. Sunflower and Floradora, which were grown in this experiment, are long staple varieties and commanded in the home market a premium of about 4 cts. per pound.

In 1905, estimating the lint at 11½ cts. per pound and the seed at 7 cts. per 100 lbs., the total value per acre ranged from $20.64 to $67.04, and in 1906, the lint being regarded as worth only 10 cts. per pound, the total acre value varied from $45.01 to $69.30.

The leading varieties of corn in a list of 18 and their yields were as follows: Sanders 28.9 bu. per acre, Marlboro 28.3 bu., Mosby 26.0 bu., and Henry Grady 25.7 bu. Sanders, Marlboro, and Mosby are several-eared sorts. Early northern varieties were again shown to be worthless for Alabama.

Cotton culture, R. J. Redding and J. M. Kimbrough (*Georgia Sta. Bul. 75, pp. 211–240*).—Twenty-six varieties of cotton were under test. In value of total products per acre the leading varieties, given in decreasing order, were as follows: Layton Improved, Cleveland Big Bell, Broadwell Double-Jointed, Cook Improved. These varieties all produced values of over $65 per acre. The average total value of lint and seed produced by the 26 varieties was $60.01 per acre, the range being from $47.15 to $75.50 per acre. The average yield of seed cotton per acre was 1,517 lbs., and the range 1,315 to 1,754 lbs.

The average results of this work for 13 years show that the best half of the number of varieties grown each year produced 34.9 per cent of lint and the others 32.5 per cent. In 1906 the best half of the varieties grown produced 36.8 per cent of lint as compared with 37.8 for 1905. The best yielding varieties also showed the larger size of bolls, although in some years there were exceptions to this rule. Earliness was in favor of the better yielding sorts during 4 seasons and in favor of the poorer yielders the remaining 9 years.

A high percentage yield of lint appears very closely related to a high value of total products. The size of the bolls is to be considered in relation to the cost of picking.

It was found that a fertilizer application, of which the nitrogenous ingredient

consists of cotton-seed meal, is most effective when bedded on from 7 to 16 days in advance of planting.

Cross planting cotton with corn was not found profitable. It was also shown that the use of sound cotton seed directly as a fertilizer or a fertilizer ingredient is a very unwise practice.

Applications of 400, 800, and 1,200 lbs. of a fertilizer consisting of 1,000 lbs. of 17 per cent acid phosphate, 498 lbs. cotton-seed meal, and 74 lbs. muriate of potash were compared. The plats receiving 400 lbs. at a cost of $4 produced 281 lbs. of seed cotton more per acre than the unfertilized plats. The use of 800 lbs. increased the yield over the check plats by 436 lbs., and the use of 1,200 lbs. showed an increase of 588 lbs. of seed cotton. Cotton hulls as a fertilizer did not prove profitable.

In a condensed review of the results of 17 years of cotton culture it is pointed out that plowing from 6 to 8 in. deep and thoroughly harrowing the land is more effective than deeper but less careful breaking and fining of the soil. Subsoiling has not been found advisable on the upland soils of middle Georgia. The results of the variety tests seem to favor a variety with large bolls, large seed, high percentage of lint, medium earliness, and persistent fruiting capacity. On land capable of yielding $\frac{3}{4}$ to $1\frac{1}{2}$ bales per acre the rows are recommended to be $3\frac{1}{2}$ to 4 ft. wide, with the plants 12 to 18 in. apart in the drills.

With regard to commercial fertilizers it is stated that these should be applied and bedded on not less than a week before planting, and that it does not pay to divide the amount into 2 or more applications, although nitrate of soda may sometimes be applied with profit a month or more after planting. As a general rule shallow cultivation once a week and once in a row is advised. The rotation of crops laid down consists of small grain followed by cowpeas the first year, cotton followed by rye or vetch the second year, and corn and peas the third year.

An interesting cross between a variety of emmer and spelt, P. H. STOLL (*Deut. Landw. Presse, 34 (1907), No. 13, p. 100, figs. 2*).—Reciprocal crosses were made between a hairy, bearded winter emmer and Stoll brown winter spelt, itself a cross between Main standup wheat and red winter spelt. The use of emmer as the male parent resulted in 5 poorly developed kernels which failed to germinate, while the use of spelt as the male parent gave a single grain which germinated vigorously and survived the winter in the open. The plant from this seed showed the beardless character of the spelt and the hairiness of the emmer. In form of spike and strength of stem it resembled spelt. The author considers beardless heads and hairy glumes as dominant and bearded heads and smooth glumes as recessive characters. The second generation was characterized by multiplicity of forms.

Flax culture, W. L. MARCY (*U. S. Dept. Agr., Farmers' Bul. 274, pp. 36, figs. 11*).—This bulletin is an extract from a report on this subject published by the North Dakota Station as Bulletin 71, which has already been noted (E. S. R., 18, p. 632).

Flax experiments, 1905 (*Dept. Agr. and Tech. Instr. Ireland Jour., 7 (1907), No. 2, pp. 250–268*).—The results of this year's fertilizer experiments confirm the conclusion of previous years that a potassic manure either in the form of kainit, muriate of potash, or sulphate of potash is generally profitable when applied to the flax crop, and that such treatment effectually prevents yellowing. A comparison of seed from different sources showed the net returns per acre from home-saved seed to be inferior to Dutch seed and Kostroma seed imported from Russia, but better than those yielded by the Belfast brand of Riga seed.

As in previous years scutching tests were made to determine the comparative

effectiveness of Irish and Belgian mills and Irish and Belgian workers. A heavier yield of scutched flax was produced in the Irish mill, but the product was of much poorer quality than the flax worked on a modified Belgian mill. The test further indicated that better results could be produced by Irish workers in mills of a somewhat lighter type than those generally used in Ireland. It is believed that for well retted straw a mill with a large number of light blades, even as many as 12 on the round, is the most satisfactory.

Rippled straw gave a slightly better yield of scutched flax than unrippled straw. Rippling gave a financial balance of 6s. 9d. per ton of green straw in its favor. The practice is recommended particularly for crops which have produced a large quantity of seed.

Half a ton of Irish grown and dried straw was retted by each of the 3 Belgian systems and by the Irish system for comparison. The home system proved the best as, while the quality of the flax yielded by the straw retted twice in the River Lys was highest, the increase in cost rendered the net returns lower than those from straw steeped in Ulster.

Investigation on correlation in fodder beets, H. Maas (*Landw. Jahrb., 35 (1906), No. 4, pp. 84–113*).—The method of carrying on this investigation is described and the data secured are given in tables.

The results show that the percentage of sugar within the variety decreased as the weight of the beet increased, but the rate of increase was not the same so that the total quantity of sugar was more dependent upon the quantity than upon the quality of the beet. Dry matter and sugar content increased regularly together in different varieties as well as within the same variety, but this correlation is not regarded as a reliable measure of either the dry matter or the sugar content in individual beets, or of the average of these substances in a number of them. The percentage of sugar in the beet increased with the percentage of sugar in the dry matter. The sugar content of the dry matter was found to be about 50 per cent when the fresh beet contained from 4.8 to 5 per cent.

Beets low in leaf area were characterized by a high content of dextrose. No correlation was apparent between the content of ash, nitrogen, crude fiber, and fat and the dry matter or the sugar content of the beet. In comparing varieties it was found that these substances in connection with an increase in sugar decrease in the dry matter, while they increase in the fresh beet. The quantity of foliage increased with the quantity of the roots. It is stated that the percentage relation of foliage and roots is determined largely by the season, the percentage weight of foliage decreasing with the weight of the root in dry seasons and increasing with the same in years of greater rainfall. The author considers the leaf area as a regulator of transpiration of high importance in the fodder beet. While leaf area and leaf quantity are connected, there is no close correlation between these 2 factors. Close planting produced a thinner leaf but a stronger leaf stem than wide planting. No connection between leaf thickness and sugar content could be determined.

Native forage plants and their chemical composition, N. E. Wilson, S. C. Dinsmore, and P. B. Kennedy (*Nevada Sta. Bul. 62, pp. 41, pls. 13, figs. 9*).—This bulletin presents the results of a chemical study of 12 species of grasses and 14 species of herbaceous plants, conducted with a view to determine the quality of the various plants for forage. Each species is described and its analysis given in a table.

Farm practice with forage crops in western Oregon and western Washington, B. Hunter (*Oregon Sta. Bul. 91, pp. 40, figs. 4*).—This bulletin is identical with bulletin 94 of the Bureau of Plant Industry (E. S. R., 18, p. 229).

Loss in weight of stored potatoes, DENAIFFE (*Jardin, 21 (1907), No. 481, pp. 76–79, figs. 2*).—The results of observations made show that the loss in weight during storage varies with the variety and is not the same for all months. Of the varieties studied the loss was about 1 per cent per month, or about 7 per cent from the time of harvesting until June 1. The loss was greatest in the varieties grown for the table, especially in the early sorts, and less in the potatoes grown for forage or industrial purposes. The early table varieties lost about 8 per cent during the storage period, while the other sorts lost only about 5½ per cent.

Results of culture experiments in 1906 at the German potato experiment station (*Deut. Landw. Presse, 34 (1907), No. 13, pp. 100–102*).—Twenty varieties under test gave an average yield of 24,770 kg. of tubers and 4,460 kg. of starch per hectare, the average starch content being 17.9 per cent. The variety Professor Wohltmann ranked first in yield of tubers with 29,560 kg., and also first in yield of starch with 5,840 kg. per hectare. Brocken stood highest in starch content with 20.5 per cent.

Results of F. Heine's potato culture experiments in 1906 (*Deut. Landw. Presse, 34 (1907), No. 14, pp. 109–111*).—Of 99 varieties tested, Hildesia, Eduna, and Sas ranked first in yield. Fürst Bismarck, which stood fifth in yield, ranked first in yield of starch and starch content. Notes on different varieties with reference to their suitableness for culinary and industrial purposes are also given.

Rice culture, R. J. NELSON (*Arkansas Sta. Bul. 94, pp. 31–45*).—It is stated that the acreage of rice in Arkansas increased from 450 acres in 1905 to about 5,000 acres in 1906. At the station rice was sown at the rate of 1¼ to 1½ bu. per acre on different dates from April 20 to May 16. The earliest sowing produced the maximum yield, 77.76 bu. per acre. The irrigation period of this crop was 84 days. The Honduras variety produced at the rate of 61.84 bu. and the Japan, 52.44 bu. of rice per acre, the average being 57.5 bu.

Notes are given on the history and food value of rice, together with directions for rice culture in general.

Sugar beet growing experiments in England, Scotland, and Ireland, 1906 (*Internat. Sugar Jour., 9 (1907), No. 98, pp. 84–91*).—The analyses of 157 samples of sugar beets are given in tables. The average sugar content of the samples was 15.46 per cent. The juice constituted 93.12 per cent and the pulp 6.88 per cent of the beets.

Injurious effect of nitrogen in the sugar beet, K. ANDRLÍK (*Ztschr. Zuckerindus. Böhmen, 31 (1907), No. 5, pp. 277–284*).—The results of experiments show that the presence of nitrogen in the beet may reduce the quality of the juice and be detrimental to the manufacture of sugar. The quantity of injurious nitrogen found in the root varied with the kind of seed. The use of a single nitrogenous fertilizer, whether in the form of nitrate or ammonia, increased the quantity of nitrogen in the beet, but the use of barnyard manure up to about 27 tons per acre under conditions of a normal rainfall produced no injurious effect. When a heavy application of nitrate of soda up to about 1,000 lbs. per acre is made the injurious effect may be largely reduced by the addition of potash and superphosphate.

Experimental work in the production of table sirup at Waycross, Ga., 1905, H. W. WILEY (*U. S. Dept. Agr., Bur. Chem. Bul. 103, pp. 38*).—The plan of the fertilizer experiments with sugar cane here reported has been previously described (E. S. R., 17, p. 458). The results for 1905, the last year of the work, are given in this bulletin together with a summary of the entire 4-year experiment.

In 1905 the fertilizer experiments were conducted at Cairo, Ga., on 2 fields, A and B. Field A, a good grade of pine land, had been in cultivation for at least 20 years, and field B, of the same grade of land, only about 6 years. The plats receiving no fertilizers produced an average of 11.07 and 14.52 tons of cane per acre on fields A and B, respectively. The highest average yields, 23.41 tons on field A and 25.84 tons on field B, were secured on the plats receiving either 1,200 or 2,000 lbs. of the normal formula in two applications.

Canes grown below the frost line in Florida were analyzed and found to be very rich. Samples received March 31 contained 20.90 per cent of sucrose, and samples received from the same locality November 11, 13.50 per cent, the purity for the 2 lots being 91.30 per cent and 79 per cent, respectively.

Grinding cane was begun at the experimental sirup factory at Waycross, Ga., November 3 and completed December 7. In 25 days of grinding 12,240 gal. of sirup was produced from 560 tons of cane. The average quantity of sirup per ton of cane was 21.87 gal. The average percentage of total solids in the juice was 15.07 per cent; of sucrose, 11.16 per cent; of reducing sugar, 2.15 per cent, and the average purity coefficient 73.63 per cent.

Analyses of the finished sirups showed an average of 75.73 per cent of total solids, 46.05 per cent of sucrose, 24.49 per cent of reducing sugar, 21.69 per cent of inversion, and 93.11 per cent of total sugar in total solids.

The results secured in the 4 years' experiment in the fertilization of sugar cane, 1902–1905, are summarized at length in tabular form and discussed. Dividing the fertilizer and making 2 or 3 applications as compared with applying it all at one time did not show a sufficient advantage to justify the practice. The results obtained by applying half of an application of 2,000 lbs. of the normal formula at planting and the other half at a subsequent period of growth gave a very large increase in yield as compared with making the application all at one time. In some cases the data apparently indicated a loss in the efficiency of the fertilizer when applied at three successive intervals instead of at two.

In experimenting with the revised formula it was found inadvisable to use in connection with it an application of 200 lbs. of nitrate of soda per acre, either in one application with 1,200 lbs. of the revised formula or at intervals. The combinations of plant food represented by either the normal formula or the revised formula gave good results and no great advantage was shown in departing widely from these formulas. The quantities of plant food contained in the normal formula are considered necessary for the production of profitable crops of sugar cane on this type of soil, and the average results of the experiment are regarded as indicating that the crop of sugar cane may be about doubled by the application of these amounts of plant food per acre.

Annual report of the bureau of sugar experiment stations for the year 1905–6, W. MAXWELL (*Ann. Rpt. Queensland Bur. Sugar Expt. Stas., 6 (1905–6), pp. 56*).—Analyses of sugar canes grown by farmers and of water for irrigation purposes, together with results of variety tests of cane from different countries, and of culture, irrigation, and fertilizer experiments, are tabulated.

The following varieties ranking in the first class for commercial sugar production are retained in the experiment and carried to the third rattoon crop: New Guinea, 4, 8A, 15, 22, 24, 24A, 24B, 26, 38, 40, 64, and 66; Mave, Trinidad 60, Yuban, N. G. 37, 47, 48, 54, and 55. Mauritius Settlers and Bois Rouge were also continued either for distribution or for other purposes.

Irrigation supplying a maximum or some excess of moisture tended to lower the purity of the juice, and manures on irrigated and nonirrigated plats, while increasing the production of the cane, produced a similar result. It is stated

that these results are not without exceptions, and that upon thoroughly exhausted land the application of mixed manures very frequently results in an improvement of quality and yield. On irrigated plats the use of manures resulted in an additional yield of 4⅓ tons of cane and of ½ ton of sugar per acre, while without irrigation the manures gave an additional yield of 3⅓ tons of cane, the increase in the sugar per acre being very small.

Cane from rows planted 4 ft. apart weighed 20 tons per acre more than cane from rows 7 ft. apart, and it was noted that the gradation was regular and progressive along the line of different widths. The cane from rows 4 ft. apart yielded 11⅓ tons of sugar per acre, while that from rows 7 ft. apart yielded 2⅓ tons per acre less.

Notes are also given on cane diseases, distribution of cane varieties, introduction of new varieties, subsidiary crops, substation work, and experiments in raising seedlings.

[Cultivation of plant crop and rattoon stubble], N. A. Cobb (*Hawaiian Sugar Planters' Sta., Dir. Path. and Physiol. Bul. 5, 2. ed., pp. 85–90, figs. 4*).—Methods of opening up stools of plant cane and rattoon crops are described and illustrated, and the advantages from the treatment accruing to fields infested with root disease are pointed out. Hoeing the earth away from the base of the stubble of a poor plant crop, and thus letting the air and light into the old stool, resulted in a fair rattoon crop. The fact that the stool of rattoon stubble under certain soil conditions is very firmly embedded in the ground brought about the construction of implements embodying the principles of the disk plow and the subsoiler, for the purpose of breaking open the stool in order to expose it to the air and the sun and to induce better growth through root pruning. A description, with illustrations, of these implements is given.

Experiments in growing Cuban seed tobacco in Alabama, G. T. McNess and L. W. Ayer (*U. S. Dept. Agr., Bur. Soils Bul. 37, pp. 32, pls. 3*).—Culture experiments with Cuban seed tobacco were conducted in 1903, 1904, and 1905. The soils taken for the experiments are described as Orangeburg clay and Orangeburg fine sandy loam, and their mechanical analysis is shown in tables. The climate of the region is also discussed, and the methods of soil preparation and cultivation are described in detail.

The object of the work was to demonstrate that a high quality of Cuban seed filler leaf can be produced on a certain soil and to secure information as to the value placed on the product by dealers and manufacturers.

In 1903 1 acre of tobacco was grown on Orangeburg fine sandy loam and 2 on Orangeburg clay. The yield amounted to 435 lbs. of merchantable tobacco to the acre. In 1904 1½ acres of each kind of soil were secured in a different locality for this work. The 3 acres yielded 1,380 lbs. of air-cured tobacco, but unfavorable conditions reduced the yield of commercial leaf to 1,001 lbs. This crop was produced at a cost of 23.7 cts. a pound.

In 1905 9 parties entered into a cooperative agreement and raised 12½ acres of tobacco under the direction of the Bureau of Soils. The yield of merchantable tobacco from this acreage amounted to 4,457 lbs., or 356½ lbs. per acre. The weight of the crop as harvested ranged from 260 lbs. to 848 lbs., and averaged 380 lbs. per acre. The largest yield was produced at a cost of 6 cts. per pound and the smallest at a cost of 12 cts. per pound. The reduction in cost of growing the heavier crop is regarded as due to better soil preparation. The profits from the largest yield amounted to $114.05 on 1½ acres, and from the smallest yield to $10.02 on 1 acre.

The crop of 1903 sold for 30 to 40 cts. a pound, and the total amount realized was sufficient to cover the original cost of growing the tobacco, the expense of fermenting, sorting, and packing, the shrinkage in weight, and other losses.

In 1904 a free distribution of the crop was made to cigar manufacturers and dealers in leaf tobacco in order that their opinions as to the quality might be obtained. "From the letters received by the Department the tobacco seems to have given satisfaction."

Milling characteristics of Australian wheats, F. B. GUTHRIE and G. W. NORRIS (*Jour. Dept. Agr. So. Aust., 10 (1907), No. 7, pp. 392–405*).—In this paper it is pointed out that South Australian wheats are characterized by strength of flour, which is always of high color and good gluten content. The Victorian wheats, while producing flour of equally good color and gluten content, are lower in strength. The flour produced in New South Wales closely resembles that produced in Victoria and South Australia, but stands midway between these two varieties in respect to strength. The Queensland wheats show high bushel weights and a high percentage of flour, but in strength they are distinctly below the wheats of the 3 States just mentioned. Western Australian wheats give a flour of high color and fair strength, but deficient in gluten. The good points of New Zealand wheats are given as good yielding power, high bushel weight, and fair flour strength, and the weak points as lack of brightness in the grain, thick bran, chalky color of flour, and deficient gluten.

The improvement of English wheat, A. E. HUMPHRIES and R. H. BIFFEN (*Jour. Agr. Sci., 2 (1907), No. 1, pp. 1–16*).—This article is a résumé of the work of improving English wheat in various parts of England and is based on a paper presented on this subject to the international convention of millers at Paris in 1905. The quality of wheats from different parts of the world is discussed, and the results of various experiments conducted to determine the factors influencing the strength of wheat as shown by baking tests are noted.

It is pointed out that soil conditions have a considerable influence on the strength of wheat, though the experiments presented give no information as to the precise factor or groups of factors which determine this influence. In testing the influence of fertilizer applications on the strength of wheat wide differences in the results were observed, but the results show satisfactorily that long-continued manuring does not increase the strength of wheat and that it may even seriously depreciate it. In connection with one of these experiments it was found that the strength of the grain from highly manured plats increased abnormally with its age and that this marked improvement in quality on ageing coincided with a deficiency of phosphates in the ash of the grain. Spring sowing of wheat did not give results showing an increase of strength in the grain. Results also show that the time of harvesting may influence the strength, but not sufficiently to bring the best English varieties to rank with such wheats as those from Manitoba.

In addition to a review of these tests the work of comparing numerous foreign varieties is described. In this work it was found that the quality of some wheats changes considerably with climatic and soil conditions, while others retain their strength under all conditions. The Fife wheats were especially prominent in retaining their strength.

In order to obtain suitable varieties of wheat adapted both to the farmers' and millers' purposes the inheritance of strength was studied in great detail, and many hybrid varieties were originated and rigidly selected. It is stated that while strength and the lack of strength in wheat may not form a pair of Mendelian characteristics, the assumption that they do has proved very valuable in building up desirable varieties. So far about 40 types, mostly of Fife parentage, have been retained as proving satisfactory in all features, and these are now cultivated to determine their yielding power. These types are diverse in habit, some being loose, others square in the head, while some have

white and others red grain; but so far as may be determined the strength of the parent Fife has been maintained.

Twenty-ninth annual report of the Swiss seed control and experiment station at Zurich (*Landw. Jahrb. Schweiz. 20 (1906), No. 2, pp. 553–576*).—At the seed-control station 9,480 samples of 171 varieties, including clovers, grasses, cereals, root crops, various other forage plants, and tree and flower seeds were tested, and results with reference to purity and germination are tabulated and briefly noted.

In one experiment red clover obtained from Upper Baden gave a much smaller yield than a variety secured from Winkel, near Zurich. *Vicia pannonica* proved to be the hardiest and the most productive of 3 varieties of vetch, including *Vicia villosa*.

A comparison of flax from different sources showed that Riga flax grew taller and coarser than either Axam, Bohemian, or Oetzthal flax. Earlier results secured with Sicilian flax indicate that this variety is much coarser than any of these 4 varieties.

Distribution of seeds and plants, E. J. WICKSON and R. E. MANSELL (*California Sta. Seed Bul., 1906–7, pp. 7*).—A brief statement of the seed distribution carried on by the station is given and notes on *Pontentilla elata*, a dry land forage plant, common and durum wheats, leguminous plants for green manuring, and a number of field and garden crops suitable for California are presented.

Hints to homesteaders, L. R. WALDRON (*North Dakota Sta. Bul. 74, pp. 263–280*).—This bulletin contains advice to settlers on the new lands of North Dakota, particularly in the drier regions. The bulletin treats largely of grain, grasses, and woody plants, and contains notes on the rotation of crops, breaking prairie sod, and other lines of work incident to opening up new lands.

HORTICULTURE.

Market gardening, R. L. WATTS (*Penn. Dept. Agr. Bul. 147, pp. 53, pls. 9*).—This is designed to give plain, practical instructions in market gardening, and is based on the experiences of the author and other leading market gardeners.

Among the factors considered are the selection of site and soil, the equipment for raising early vegetables, the importance and use of different forms of fertilizers, liming of soils, tillage, and the source of seed supply. Plain cultural directions are given for all the well-known market garden crops, together with fertilizer formulas for different vegetables and tables showing the number of plants and quantity of seed required per acre for various distances.

Station novelties in truck crops and further distribution of seeds, B. D. HALSTED (*New Jersey Stas. Bul. 199, pp. 30, pls. 4, figs. 7*).—The plant breeding work and seed distribution previously noted (E. S. R., 17, p. 864) was continued during the season of 1906, and the present bulletin consists largely of additional reports on novelties of former years and notes on others which have not yet been distributed.

The Malakhov-Premo cross of sweet corn has been called Malamo, and is said to produce much larger ears than and to be nearly as early as its parent Malakhov. The Malakhov-Crosby sweet corn, now called Malakosby, while not quite so early as the Malamo, has been received with favor, and is said to be remarkable for its vigor of stalk and large yield of superior ears. Notes are also given on further crosses of sweet corn, including Adams-Crosby and crosses of Golden Bantam with Essex Early, Country Gentleman, and Premier.

Of the novelties in tomatoes Magnerosa continues to give satisfaction. The

Marvel-Ponderosa, now called Marvelosa, is giving favorable results and will be further tested. Crosses of Crimson Cushion with Marvel and Matchless are also described. The Long White-New York Improved eggplant and the Delicious Bay-State squash crosses will be tested during the coming season.

Notes are given on 2 Chinese vegetables, Pe-Tsai and Pak-Choi, the seed of which was received last spring from the Department of Agriculture. The latter is said to be quite like a cabbage in color and texture, while the former somewhat resembles a giant lettuce. These vegetables may be used either in the same manner as cabbage or cauliflower or in the making of salads.

The former list of seeds for distribution has been revised by eliminating such varieties as Voorhees Red sweet corn, Station Bush Lima bean, Station Yellow tomato, and the Jersey Belle eggplant, which have become well introduced throughout the State. A number of unpromising varieties have been discarded, and the present list contains many of the recent novelties.

Manuring fruit trees (*Belg. Hort. et Agr., 18 (1906), Nos. 23, pp. 360, 361; 24, pp. 376, 377; 19 (1907), Nos. 1, p. 9; 2, p. 25; 3, p. 44*).—This article is devoted largely to a discussion of the various materials used for fertilizers, either alone or in combinations, in respect to their chemical nature and their use on soils of different composition and for different kinds of fruit trees. Brief notes on the benefits and methods of applying the fertilizers, together with suggestions for making fertilizer tests, are also given.

Grapevine culture, W. HARRIS (*Bul. Dept. Agr.* [*Jamaica*], *5 (1907), No. 1, pp. 28, figs. 6*).—During the past 18 years numerous articles and notes on different phases of grape culture have been published in the bulletins of the department of agriculture of Jamaica. This information has been collected and arranged under suitable headings and is here presented in pamphlet form for the convenience of grape growers.

The methods of propagation, selection of site, preparation of soil, planting, pruning, fertilizing, disbudding, thinning of the fruit, and diseases of the vine with their remedies are among the important phases considered, together with a discussion of varieties and the markets for grapes. An extensive bibliography pertaining to the culture of grapevines is also given.

The Cinsaut grape, J. W. MILLS (*Cal. Cult., 28 (1907), No. 9, p. 212*).—The Cinsaut grape, which is described as a purplish black grape resembling the Black Malvoisie but possessing shorter and more compact bunches, is said to be especially adapted to the high and dry mesas of southern California which are incapable of being irrigated and are ordinarily too dry for the culture of most varieties of grapes. It is said to have met with much favor in the vicinity of the Pomona experiment station, but is not recommended for planting in humid lowlands where the fruit is liable to be tasteless and watery, with a high acid and low sugar content. When grown in warm, dry situations not subject to severe frosts after the budding season it is reported an excellent table grape, but must be gathered shortly after maturity since it soon loses its good qualities.

The author further states that this grape is grown extensively in the south of France, and yields a heavy-bodied but delicate and highly flavored wine, used widely in making blends. The average yield of fruit is given as 4 tons per acre.

The bagging of table grapes, O. OPOIX (*Rev. Vit., 27 (1907), No. 687, pp. 173-176, figs. 3*).—The author has conducted experiments in the bagging of table grapes, growing both on trellises and along walls, since 1901. The results obtained prior to the season of 1906 are said to be satisfactory in many ways, but considerable failure was noted on account of the scalding of the bagged fruits during continued periods of hot weather.

In 1906 a new style of bag was tried for the purpose of determining its value in eliminating this scalding. Previous to this time a thin, transparent paper bag

had been used, ventilation being afforded by cutting off the bottom ends of the folded bag and making a V-shaped cut in the center of the bottom. In the new bag the bottom was removed and a cloth covering added. The bag was reenforced with a cardboard band near the upper end, thus preventing it from coming in contact with the grapes, and it was also encircled near the lower edge with a fine brass-wire thread, by means of which it was possible to open the bottom during warm weather and nearly or completely close it during humid, rainy, or cold periods. After the bunch was inserted the bag was attached to the supporting vine in order not to hamper the normal development of the bunch stem. Over 600 bunches of grapes were treated in this manner, and the author states that the grapes enclosed in this way were much larger than those enclosed in the former poorly ventilated bag.

An experiment was also conducted to determine the effect of bagging the grapes before the flowering season. Several bunches were selected for this purpose at different heights on the trellis and vine. In this case the lower end of the bag was allowed to remain open. With the grapes thus treated there was no early dropping of the berries and they were larger and at least 10 days further advanced than unprotected grapes.

The 3 different periods which the author suggests as being suitable for bagging grapes are previous to the flowering season, in order to protect the bunches from the cold and wet spring weather; immediately after the grapes have been thinned, at which time the author secured his best results, and when the grapes begin to mature, in order to protect them from wasps and other insects as well as to retain the bloom of the grape. Sacking according to the method described is said to be very simple and inexpensive and has the advantage of affording opportunity for both thinning the berries and inspecting the condition of the grapes from time to time without the removal of the bags.

Aside from the increase in the size of the bagged grapes as compared with grapes grown in the open, the other advantages as the result of these experiments were that the bagged grapes were from 12 to 15 days earlier, and that, although they were slightly paler in color, the skin was very fine and transparent and had a slightly golden appearance, thereby causing them to resemble greenhouse-grown grapes. Bagging also served as a protection from insects and adverse weather conditions. It is stated that the grapes may be left on the vines in bags through December or even later where the winter temperature is not too severe, since they will easily withstand a minimum temperature of 4 to 5 degrees C. for a period of several days.

Fruit preserving, A. Mendoza (*Jour. Dept. Agr. Victoria, 4 (1906), No. 11, pp. 674–679, figs. 3*).—Brief instructions for amateurs are given for the preservation of fruits in various forms of glass and tin packages. The different methods of preserving are discussed and specific directions are given for the manufacture of sirup and the previous preparation of apricots, peaches, apples, pears, and quinces. The canning in tins is said to be more economical but not so convenient as canning in glass jars.

Directions are also given for the making of fruit pulp by simply boiling any kind of fruit which can be used for jam making or in similar ways with just sufficient water to cause the juice to run, so as to stew the fruit in its own moisture. When boiled sufficiently to sterilize it the pulp may be placed in bottles in a manner similar to that in ordinary methods of canning fruits. Nothing in the way of sugar or other matter is added to it.

Fruit preserving for domestic supplies, G. Quinn (*Jour. Dept. Agr. So. Aust., 10 (1906), No. 5, pp. 266–277, figs. 6*).—Popular directions are given for the preparation and preserving of stone and pip fruits, berries, and vegetables,

and the making of preserving sirups, together with a discussion of the principle underlying fruit preservation and the appliances required for the work.

Opportunities in the South for preserving fruit and vegetables (*Tradesman, 56 (1907), No. 12, pp. 47, 48*).—A popular description is given of the various processes in the canning of tomatoes in the commercial canning houses of Maryland, and data are presented in connection with the canning industry, both of this State and California. A discussion of the possible development of the canning industry in those sections of the South where large quantities of truck crops and orchard fruits are grown is included.

[Statistics with reference to the imports and acreages affecting British horticulture] (*Jour. Roy. Hort. Soc. [London], 31 (1906), pp. 183–188*).—Tabulated statistics are given showing the quantity and values of fruit and vegetables imported into England during the seasons of 1903, 1904, and 1905.

Of the total acreage in the United Kingdom only 245,815 acres, or less than 1 in 300, are under fruit cultivation. It is reported that the imports of fresh flowers continue to decrease from year to year, since forcing methods are becoming better understood in England. Some of the vegetables have been reported to be increasing in acreage, such as beans, potatoes, mangel-wurzels, cabbage, onions, and carrots, while a few of the chief root crops, such as turnips and swedes, show a slight decline.

FORESTRY.

First annual report of the State forester of Wisconsin, E. M. GRIFFITH (*Ann. Rpt. State Forester Wis., 1 (1906), pp. 67, pls. 12*).—A report of the progress and condition of the State forest work for 1906, with recommendations for improving the State system of forest protection, management, afforestation, and taxation.

Considerable data is presented relative to forest conditions in various parts of the United States. Within the past 2 years the State forest reserves have grown from 40,000 to 234,072 acres. Arrangements have been made whereby the State board of forestry is to cooperate with the Forest Service of this Department on the various Indian reservations in Wisconsin. It is the policy of the State to withhold for forestry only those lands which are of no value for agricultural purposes.

The work of the fire wardens is given in tabular form. The number of forest fires reported for 1904 was 140, and the number of acres burned over, 56,777. In 1905 there were 160 fires, in which 76,125 acres were burned over. Over half of these fires are said to have been started by settlers clearing land and burning for pasture.

An appendix contains the State forestry laws of 1905, under which the forestry board was established. The report is illustrated by several photographs, reproduced by permission of the Forest Service, pertaining to forest problems in different parts of the United States.

Annual report upon state forest administration in South Australia 1905–6, W. GILL (*Ann. Rpt. State Forest Admin. So. Aust., 1905–6, pp. 12, pls. 6*).—This is a report of the year's progress in forest investigations and in the operation of forest reserves and plantations in South Australia, and is similar in nature to previous reports (E. S. R., 16, p. 880).

The total area of forest reserves for the fiscal year 1906 was 170,135 acres. During the year 101 acres were inclosed for planting and reforestation, making a total of 14,122.25 acres inclosed. Of 81,544 trees planted during the year 53,407, or 65½ per cent, are reported as living. During the past 24 years the

department has distributed 6,484,675 trees in response to applications from 30,223 persons. The date palms which have been under observation for several years made satisfactory growth during the season and bore a full crop which, however, was later damaged by heavy rains at the ripening period.

An appendix contains tabulated statements of trees planted and alive, amounts of expenditures and receipts, and a comparative statement of revenue, expenditure, and legislative provision for the past 30 years ending June 30, 1906, together with several illustrations giving an idea of the extent of the plantations and development of the timber.

Review of forest administration in British India for the year 1904–5, S. Eardley-Wilmot (*Rev. Forest Admin. Brit. India, 1904–5, pp. 11 + 60, map 1*).—This review deals with the various forest operations for 1904–5 and is of a similar nature to that of the previous year (E. S. R., 17, p. 1160).

There have been several alterations in area in the different provinces, but the total forest area of 232,941 sq. miles shows little increase over the preceding season. The working plans in force at the end of 1905 included an area of 37,977 sq. miles. The total yield of timber and fuel was 251,568,276 cu. ft., 215,261,179 bamboos were cut, and minor forest products to the value of 5,816,-926 rupees were produced. The net increase of timber and fuel over the preceding year amounted to over 19,000,000 cu. ft., and about 17,000,000 more bamboos were extracted than in 1903–4. The gross revenue for the year was 24,029,950 rupees and the gross expenditure 12,967,856 rupees. Of the exotic species of seeds tested in the United Provinces the American hardy catalpa was the most successful, 2,000 out of 2,500 seeds sown having germinated.

Several appendixes are devoted to tabulated data dealing with forest areas and surveys, expenditures, products, receipts, etc. A map is given which shows the progress of forest surveys in India.

Sand-binding and afforestation in southwestern France, Jentsch (*Forstw. Centbl., 29 (1907), Nos. 1, pp. 10–31; 2, pp. 77–96, pl. 1, figs. 9*).—An extensive account is given of the reclamation and afforestation of about 800,000 hectares of formerly barren sands along the coast of southwestern France. Among the important phases considered are the planting systems, species of trees used, sylvicultural practices, the systems of exploitation, and the products and revenues of the forests.

The walnut in Oregon, C. I. Lewis (*Oregon Sta. Bul. 92, pp. 43, pls. 23*).—This bulletin is designed to meet the "present urgent need" for information concerning nut culture in Oregon, and is based largely on the experience of the Pacific coast nut growers.

The subject-matter deals with the important phases of propagation, planting, subsequent care, harvesting, marketing, and diseases and insects, as well as suitable soils and varieties. The introductory remarks give the present status of nut culture in Oregon, together with the principal nut-growing sections. The Oregon nut growers are of the opinion that the late-blooming French varieties are best adapted to that region, and of these Mayette and Franquette are the general favorites.

Florida soap trees, "Saponidas manatensis utilis" and "S. saponaria," E. Moulie (*Amer. Soap Jour. and Manfr. Chem., 17 (1907), No. 6, pp. 124, 125*).—The berries of the soap bush (*Sapindus utilis*) in Algeria are said to be rich in an alkaline principle known as saponin, useful in the manufacture of soap.

Two or more species of Sapindus grow in Florida, and the author states that he has been successful in producing saponin from 2 species of Florida soap trees, which he designates as *Saponidas manatensis utilis* and *S. saponaria.* The characteristics and possible uses of this oil are discussed. The author is

of the opinion that a large number of seeds from both the Florida and Algerian forms will be planted in Florida with the view of developing the industry.

Rubber in the East, J. C. Willis, M. K. Bamber, and E. B. Denham (*Peradeniya Manuals. 1906, No. 1, pp. VIII+269, pls. 24, figs. 7, maps 7*).—This is volume 1 of a series of manuals on tropical botany, entomology, agriculture, and horticulture, which are to be written by the staff of the Peradeniya institution and other writers and published at intervals. It contains the official account of the Ceylon rubber exhibition held in the Royal Botanic Gardens, Peradeniya, September, 1906.

In the several lectures delivered at the exhibition the various phases of rubber, from cultivation to vulcanization, were considered, together with a discussion of cotton, tobacco, camphor, lemon grass, and citronella. These lectures, together with the discussions following them, have been revised and arranged in logical order with the purpose of making this account a standard treatise upon the rubber industry as it exists at present. The cultivation of rubber in Ceylon and other countries is described, the treatment of diseases, catch crops for rubber plantations, tapping knives, machinery for the treatment of latex or rubber, shipping, marketing, vulcanization, etc.

Para rubber: Distance and interplanting, H. Wright (*Trop. Agr. and Mag. Ceylon Agr. Soc., 28 (1907), No. 1, pp. 2–9*).—The author discusses somewhat at length the following 5 systems of planting Para rubber trees: Close planting—permanent; close planting and thinning out; wide planting—permanent; wide planting with catch and inter-crops, and interplanting with herbaceous and arborescent plants.

The permanent—close and wide planting systems—are not considered of much value, since the former is said to be wrong in principle and the latter extremely wasteful. The author is in favor of those systems which allow the provision of increased root area as the rubber trees advance in age and increase in size. This may be brought about by thinning out the rubber trees, inter-crops, and other plants from time to time.

Cultivation of Manizoba rubber (Manihot glasiovii), R. U. Uribe (*Bol. Soc. Agr. Mexicana, 31 (1907) Nos. 7, pp. 121–124; 8, pp. 143, 144*).—An account of the cultivation of the "Manizoba" rubber tree in Brazil, including a botanical description and notes on adaptability to climate and soil, planting, cultivation, methods of exploitation, and yields.

The author considers the "Manizoba," which is generally known as *Manihot glasiovii*, or the Ceara rubber tree, especially adapted to the conditions in Colombia, where it is believed that the financial returns would be greater than from cotton, sugar cane, or coffee, especially if the trees were planted by small farmers who could manage and gather the rubber themselves.

The bamboo and its uses, Ergates (*Natal Agr. Jour. and Min. Rec., 9 (1906), No. 12, pp. 1175–1177, pl. 1*).—The bamboo is said to be of great value as a wind-break for fruit crops and as material for making fruit boxes and ladders, as well as in the construction of walls and doors for sheds and stables, water troughs for poultry, and handles for hammers and other small implements.

The method of making bamboo fruit boxes is described. The ends of the smaller boxes are made of solid wood, while those of the larger boxes are made of square frames filled in with small bamboo slats, with the sides of bamboo slats. A box 2 ft. 2 in. by 1 ft. 6 in. and 9 in. deep is said to cost about 30 cents. At present the limited supply of bamboo does not warrant the manufacture of these boxes as an independent business.

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DISEASES OF PLANTS.

Report of the phytopathological section of the agricultural institute, 1906, E. MARCHAL (*Bul. Agr. [Brussels], 23 (1907), No. 1, pp. 39–47*).—After a tabular list of diseases that have been reported upon during the year, notes are given on a number of those which were most troublesome, with suggestions for their control. Among those described are bean anthracnose, downy mildew of grapes, cherry scab, and apple scab.

Some publications in 1906 on the heterœcism and specialization of Uredineæ, E. FISCHER (*Bot. Ztg., 2. Abt., 65 (1907), No. 4, pp. 49–54*).—The author briefly reviews the published results of Arthur, Fischer, Müller, Schneider, Shear, Tranzschel, and others relating to the heterœcism of various species of Uredineæ and the specialization of forms on certain host plants. Most of these publications have been noted elsewhere.

Volunteer wheat and rust, E. J. BUTLER (*Agr. Jour. India, 2 (1907), No. 1, pp. 99, 100*).—It is said that in some countries the outbreak of rust in wheat is ascribed to the carrying over of the fungus on volunteer wheat. This theory of propagating the fungus can hardly be accepted in India, as it is said that the weather is so hot after a crop is cut that usually no plants can be found until the next crop is sown. In addition, it has been learned that the rust spores themselves can not survive exposure to the intense heat that is experienced in the hot weather months. In order to explain the annual appearance of rust in India through the medium of volunteer wheat, the author says that it will be necessary to assume a combination of conditions that does not exist.

Smut diseases of cereals and a method for combating them, O. APPEL and G. GASSNER (*Mitt. K. Biol. Anst. Land u. Forstw., 1907, No. 3, pp. 20, figs. 8*).—A summary is given of the present state of information regarding cereal rusts, the species described being *Ustilago tritici*, *U. hordei*, *U. jensenii*, *U. avenæ*, *U. levis*, *Tilletia tritici*, and *T. levis*.

Since the infection takes place through the flowers and treatment of the seed is of doubtful expediency, the author recommends for the prevention of loose smut of wheat and barley the selection of seed from isolated noninfested regions. For the bunt or stinking smut of wheat, black or hard smut of barley, and both the loose and covered smuts of oats seed treatment is said to be efficient.

A description is given of a form of apparatus that has been devised for the hot-water treatment of seed, in which the proper temperature is maintained by steam.

A grass-killing slime mold, J. W. HARSHBERGER (*Proc. Amer. Phil. Soc., 45 (1906), No. 184, pp. 271–273*).—In August, 1905, the author's attention was called to a lawn in which the grass was being destroyed in areas varying from a few inches to several feet in diameter. The trouble seemed to begin after a series of night showers, the grass having become blackened here and there over the lawn. Subsequently it was reported that only the blades of the lawn grasses were destroyed, and that after the disease had disappeared the grass regained its fresh bright green color.

Specimens of the dead grass were submitted for examination, and the author reports having found them infested with the slime mold (*Physarum cinereum*). The abundant production of the plasmodium of this mold had caused the destruction of the grass, and its occurrence on the living grass leaves demonstrates that the organism had changed its habit from that of a saprophytic life to a parasitic one.

Concerning a fungus-free darnel, E. HANNIG (*Bot. Ztg., 1. Abt., 65 (1907), No. 2, pp. 25–38*).—A report is given on studies of *Lolium temulentum*, particu-

lar attention being given to the occurrence of a race of this species which does not appear to be infested by the fungus to which the poisonous properties of darnel are attributed.

Selection for disease-resistant clover, S. M. BAIN and S. H. ESSARY (*Tennessee Sta. Bul., Vol. XIX, No. 1, pp. 10, figs. 5*).—In carrying on their investigations with clover anthracnose (*Colletotrichum trifolii*), a preliminary report of which has already been given (E. S. R., 17, p. 567), the authors found that in some badly infected fields there were here and there individual plants that possessed a high degree of resistance. With this fact in mind, a series of experiments was planned to develop a resistant strain of clover, and a preliminary report is given of the results thus far obtained.

In one of the experiments a plat was planted with seed from resistant plants obtained from different sources, and comparisons made with ordinary commercial seed grown under similar conditions. After seeding the plats they were covered with infected hay in order to insure the presence of the disease among the selected plants. Toward the close of the season 95 per cent of the seedlings from the resistant plants were alive, while not more than 5 per cent from the nonselected plants had survived the disease.

The investigations thus far carried on indicate that there is a strong resistance on the part of some plants toward this disease. This fact has been taken advantage of as rapidly as possible, but as yet no seed is available for distribution.

Spraying potatoes, E. J. BUTLER (*Agr. Jour. India, 2 (1907), No. 1, pp. 95, 96*).—An account is given of potato spraying experiments in which 3 plats were sprayed in duplicate with Bordeaux mixture. One plat was sprayed with plain Bordeaux mixture, the second with Bordeaux mixture to which a small quantity of resin-soda solution was added, and the third with Bordeaux mixture containing unrefined sugar. The quantity of Bordeaux mixture used was at the rate of about 300 gal. per acre, 60 gal. being applied at the first application and 120 gal. at each of the other applications.

The yield of the different plats is shown, from which it appears that the spraying resulted in a substantial profit. The largest returns were obtained from the plats sprayed with Bordeaux mixture to which resin and soda were added, followed by Bordeaux mixture containing sugar, and plain Bordeaux.

Some elements of plant pathology, N. A. COBB (*Hawaiian Sugar Planters' Sta., Div. Path. and Physiol. Bul. 4, pp. 50, figs. 32*).—This is an address on the diseases of plants especially related to sugar cane delivered by the author before the annual meeting of the Hawaiian Sugar Planters' Association.

Fungus maladies of the sugar cane, N. A. COBB (*Hawaiian Sugar Planters' Sta., Div. Path. and Physiol. Bul. 5, pp. 254, pls. 8, figs. 102*).—A report is given on investigations of a number of diseases of sugar cane, together with notes on associated insects and nematodes. Among the diseases described are root diseases, leaf-splitting blight, rind disease, pineapple disease, and a disease to which the name "eleau" is given.

The principal root disease described is that due to the basidiomycetous fungus *Ithyphallus coralloides* n. sp. This disease is estimated to cause in some districts losses amounting to 10 per cent of the rattoon crop, with somewhat less on fields of plant cane. The fungus, which is almost entirely a subterranean one, only coming to the surface of the ground when the fructifications are formed, attacks the cane through wounds and the cut ends of the plant cane, from which it spreads along the fibrovascular bundles into the interior of the plant. It was found that flies play an important part in spreading the spores of the fungus, and extended studies were made on the rôle of flies and other insects in the dissemination of this disease. In addition to the

Ithyphallus considerable injury is caused by *Marasmius sacchari hawaiiensis* n. var., which also attacks cane, causing a root disease. The best means for combating the root diseases are cultural methods, the use of resistant varieties, the destruction of the fructifications, and the eradication of flies.

The leaf-splitting blight, caused by *Mycosphærella striatiformans* n. sp., is especially destructive to young cane, particularly during the cool season. The leaves show alternate colorations, and the tissues dry up, after which the leaves split badly. No remedies are known for holding this disease in check.

The rind disease described is due to *Trichosphæria sacchari*, and it is said to be a well-known disease that follows wounds on cane. It is very prevalent on some plantations, and is to be combated by the use of resistant varieties and the complete destruction of the spore-bearing dead stalks.

The pineapple disease (*Thielaviopsis ethaceticus*) attacks plant cane through the cuttings. It is characterized by a peculiar discoloration running through the cane, accompanied by a more or less pronounced pineapple odor. The soft varieties of cane seem very susceptible to this disease, and the use of tops for planting is advised. In making cuttings for planting care should be taken not to shatter the ends of the cane, and it has been found desirable to treat the cuttings before planting with some fungicide such as Bordeaux mixture. This fungus also attacks pineapples, sometimes causing severe losses.

The disease called eleau is widespread, but does not seem to be of very great economic importance. Young stalks are attacked here and there in the field and appear discolored and shrunken, with dry leaves and leaf sheaths bound together. Insects appear quite commonly within the leaf sheath and they are possibly concerned with the disease.

Technical descriptions are given of the different fungi concerned in these diseases and about a score of new species of nematodes are described. These are included, as the wounds formed by nematodes on the roots aid fungi in gaining entrance to the cane plant.

The heart rot of beets, C. MERLE (*Sucr. Indig. et Colon., 69 (1907), Nos. 5, pp. 125–129; 6, pp. 148–152*).—A description is given of beet root rot, due to *Phoma betæ*, or *P. tabifica* of some authors, the ascigerous form of which is now recognized to be *Sphærella tabifica*.

The disease usually makes its appearance late in summer, and seems most destructive on certain types of soil during prolonged drought and on certain varieties. Sandy soils containing an abundance of silica with rather impervious subsoil appear to favor its spread. Associated with the fungus causing the root rot are a number of other species, but they are shown to be completely saprophytic.

For the prevention of loss by this disease the author recommends deep plowing before the beginning of winter, the application of large quantities of wood ashes to the soil, long rotation, and the planting of some of those varieties that have been shown to be resistant to the fungus attacks.

Cabbage leaf spot (*Gard. Chron., 3. ser., 41 (1907), No. 1054, p. 164*).—In response to an inquiry the editor states that the conidial stage of *Sphærella brassicæcola* has become unusually common and destructive in parts of England. For its prevention it is recommended that diseased plants be pulled up and burned, the soil disinfected, and no cruciferous plants allowed to occupy the soil for at least 2 years. Any unaffected plants should be sprayed with Bordeaux mixture so as to prevent infection. The fungus seems to be becoming increasingly destructive, and it is urged that means be taken to prevent its spread by burning the dead leaves and other refuse.

Stem canker and drop of cabbage plants, J. RITZEMA BOS (*Ztschr. Pflanzenkrank., 16 (1906), No. 5, pp. 257–276, figs. 13*).—As a result of studies

carried on for a considerable period, the author has determined that the stem canker and the drop of cabbages are manifestations of the same disease, both being caused by the fungus *Phoma oleracea*. A technical description is given of the fungus, and the effect which it produces upon the host plant is described.

The practice of leaving cabbage stalks standing in the field is condemned, as the fungus is carried over the winter in them. Investigations seem to indicate that the fungus can not attack sound roots, but must find entrance through wounds and insect injuries. In the latter class especial attention is called to the cabbage maggot (*Anthomyia brassicæ*), which should be rigorously attacked in order to prevent injuries which may be followed by the fungus.

A spot disease of stone fruits, P. VOGLINO (*Italia Agr., 1907, pp. 12, 13, pl. 1; abs. in Riv. Patol. Veg., 2 (1907), No. 7, pp. 104, 105*).—A disease of cherries, peaches, and almonds, in which the leaves, twigs, and maturing fruits are attacked by the fungus *Clasterosporium carpophilum*, is described. The fungus produces discolored spots on the foliage and soon the tissues in these areas dry and fall out, the leaves presenting a ragged appearance. Sometimes a copious exudation of gum accompanies the disease, but the author was unable to establish any relation between the fungus and the formation of gum. It is believed that the gum is due to the arrested development of the cambium.

Spraying trees at frequent intervals with a 5 per cent solution of copper and iron sulphate and lime has given good results. The application of a solution of 10 per cent iron sulphate and 5 per cent lime to the trees during winter is recommended as an additional precaution.

Pear canker and means for its control, G. PAPAROZZI (*Rome: Offic. Poligrafica Ital., 1906, pp. 29, figs. 7; abs. in Riv. Patol. Veg., 2 (1907), No. 7, pp. 103, 104*).—An experimental study was carried on to determine the etiology of pear canker, the relative resistance or predisposition of different varieties to the disease, and the efficiency of various methods of control.

The cause of the canker was found to be the fungus *Nectria ditissima* following frost injuries. If protected from the action of cold no canker was found on pear trees. Wide variations were found in predisposition to the disease, and in making plantings in exposed regions susceptible varieties should be omitted. When cankered areas are observed on trees they should be cut out, and the wound treated with carbolic acid or corrosive sublimate, after which it may be covered with a mixture of resin, alcohol, and coal dust.

Experience in combating grape downy mildew in 1906, HENSLER (*Prakt. Bl. Pflanzenbau u. Schutz, n. ser., 5 (1907), No. 2, pp. 18–23*).—An account of a series of experiments with Bordeaux mixture for the prevention of downy mildew of grapes due to *Peronospora viticola*.

Various strengths of the fungicide were used, and although the season was a very rainy one, the results obtained were so encouraging that the author feels warranted in recommending the treatments for 1907. He suggests that the vines be thoroughly sprayed with not less than a 2 per cent solution of Bordeaux mixture. The first application should be given in May when the young shoots have attained a length of 20 to 25 cm. The second spraying should be made just before the opening of the flowers, followed by a third immediately after the flowering period is over. Two or more additional applications should be given at intervals during the season, depending on the state of the weather and the development of the fruit. There is said to be no economy in the use of very dilute solutions, and thoroughness of application to all parts of the vine is a prime requisite for the success of the treatment.

Localized stem blight in Ohio vineyards, A. D. SELBY and J. M. VAN HOOK (*Ohio Sta. Circ. 64, pp. 6, figs. 2*).—In August, 1906, the authors' attention was called to an extensive dying of grapevines in Ashtabula County, Ohio. The

trouble had become serious in 1905, and at the time of the authors' visit in 1906 it was found that many of the vines had died. In some cases the old roots had put out sprouts, some of which were wilting, and in some instances new vines had been planted in place of the old ones.

The wilting of the vines is a conspicuous character of the disease, the leaves and tender shoots first showing by their wilting that the disease is present, after which they droop and finally dry up, while the berries are shriveled. In studying the winter condition of the disease the authors found that if the old bark is stripped off the diseased stems, on the inner bark will be found rows of black dots arranged more or less in longitudinal elevations.

A study of specimens showed that they were identical with the parasite reported by Atkinson in New York in 1904 and referred by him to a form of the grape anthracnose.

While investigating this disease the authors found that it was also present in a 13-year-old vineyard at the station. This vineyard had been regularly and thoroughly sprayed with Bordeaux mixture, followed by ammoniacal copper carbonate, but the presence of the disease seems to reflect against the efficacy of Bordeaux mixture alone as a remedy against this disease.

Based upon investigations carried on in Europe and elsewhere, the authors recommend the spring treatment of all vines with a solution of iron sulphate, sulphuric acid, and water. As a precautionary measure it is recommended that diseased portions of vines be cut out and burned.

In order to study more thoroughly the distribution of the fungus, the authors request correspondence relating to it and ask that suspected specimens be sent them.

A mulberry disease in Kashmir, E. J. Butler (*Agr. Jour. India, 2 (1907), No. 1, pp. 97, 98*).—An account is given of a serious disease of mulberries which has not previously been recorded in India. The disease is found in old trees without causing appreciable damage, but great harm is done to young plants in nurseries, a fungus attacking the seedlings in their second or subsequent years. It is said not to kill the seedlings outright, but as the affected plants have to be cut back below the diseased parts, several years' growth is lost.

The disease is said to be caused by the fungus *Coryneum mori*, which invades the wood and young branches and results in the withering of the branches, which drop their leaves.

This disease is already known in Japan, and it is possible that it was introduced into India from that country. How serious it is likely to prove it is as yet impossible to predict, as methods for its control are not known.

The coffee nematode, G. Gándara (*Com. Par. Agr. [Mexico] Circ. 51, pp. 7, figs. 6*).—A description is given of attacks of *Heterodera radicicola* on coffee, and attention is called to the loss which this nematode has caused to coffee plantations in Brazil and elsewhere. The effect on the host plant is noted, after which various cultural remedies are described. In addition to methods of cultivation that are based upon stimulating the growth of the trees, it is suggested that various substances be injected about the trees for the destruction of the nematodes. Among those mentioned are gasoline, benzine, iron sulphate, carbon bisulphid, sulphocarbonate of potassium, etc.

A good method for combating Pestalozzia palmarum on cocoanut palms, C. Bernard (*Teysmannia, 17 (1906), No. 10, pp. 654–657*).—For preventing the spread of *P. palmarum* on cocoanut trees the author recommends a treatment which has been found efficient on an estate in Java. This consists in cutting out the diseased portions of the tree as soon as the fungus spots appear and burning or deeply burying the material. The author adds the precaution of

burning all fallen rubbish about the trees and treating the prunings with a solution of corrosive sublimate before burying them.

The tulip disease and its prevention or cure (*Gard. Chron., 3. ser., 41 (1907), No. 1055, p. 168*).—The writer states that many complaints from Holland, Germany, and elsewhere have been received relating to the failure of tulips to bloom, and a report is given on experiments for the control of this disease. These experiments are based upon the observations of Klebahn that the disease is due to 2 fungi, *Botrytis parasitica* and *Sclerotium tuliparum*.

The Botrytis form usually shows itself in the early spring by the backward, sickly appearance of the first tulip sprouts or by their failure to appear altogether. Upon lifting the diseased bulbs small black fungus spots will be observed upon them, or if affected by the Sclerotium the spots will be larger and dark brown in color.

As these fungi remain in the soil for a number of years, the treatment undertaken is based upon the removal of the fungus, and the only practical plan thus far advised is to lift out the bulbs that show signs of disease, together with the surrounding soil, as early in the spring as possible and to destroy the bulbs and completely sterilize the soil by burning it. This treatment, persisted in for a number of years, it is claimed has resulted in the eradication of the disease from a large tulip nursery in Holland.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The fox: A dangerous pest, and a plea for its extermination, S. McIntosh (*Jour. Dept. Agr. So. Aust., 10 (1907), No. 6, pp. 373, 374*).—Attention is called to the rapid multiplication of the fox in South Australia. This animal is an introduced species and may be considered of some benefit in destroying rabbits. The author fears, however, that it will ultimately multiply to such an extent as seriously to threaten the poultry and sheep business.

Insects as the food of squirrels, W. T. Davis (*Canad. Ent., 39 (1907), No. 1, p. 16*).—Squirrels were observed opening hickory nuts for the purpose of obtaining the larvæ of snout beetles in them. Notes are also given on other insects occasionally eaten by squirrels.

A study of the stomach contents of native carnivorous birds, G. Rörig (*Arb. K. Biol. Anst. Land u. Forstw., 5 (1906), No. 5, pp. 237–265*).—The author made an examination of the stomach contents of 1,154 carnivorous birds, including eagles, fishhawks, and various other hawks and owls. The results of these investigations are presented in a tabular form showing the percentages of beneficial and injurious animals which constitute the food of the birds.

The digestion of various food stuffs in the stomach of crows, G. Rörig (*Arb. K. Biol. Anst. Land u. Forstw., 5 (1906), No. 5, pp. 266–278*).—In studying the stomach contents of birds for the purpose of determining their food habits, it is desirable to know the rapidity of digestion of the various elements of food in the species which is being studied. The author found that when the stomach is filled with a considerable variety of food the softer parts of animal origin rapidly disappear, while hard elements remain in a recognizable form not much longer than the hulls of grain. All of these hard elements seem to retain their original form longer when the quantity in the stomach is smaller and the variety of food elements less.

The bone content of the pellets of Asio otus, M. Schwartz (*Arb. K. Biol. Anst. Land u. Forstw., 5 (1906), No. 5, pp. 279–281, pl. 1, fig. 1*).—In studying the pellets cast up by this species of owl, the author finds that in most instances the bones are left in their original relation to one another, the softer parts having disappeared under the influence of the digestive juices.

International catalogue of scientific literature. N—Zoology (*Internat. Cat. Sci. Lit., 4 (1906), pts. 1, pp. VIII + 405; 3, pp. XII + 384*).—The zoological literature indexed in these two parts of the international catalogue is mainly that of 1904, but also includes a number of entries of literature published from 1901 to 1903. As in previous parts of this catalogue, the material is indexed under the author's name and also by subjects.

Second biennial report of the commissioner of horticulture of the State of California, 1905–6 (*Bien. Rpt. Comr. Hort. Cal., 2 (1905–6), pp. 557, pls. 4, figs. 169*).—The reports of the commissioner of horticulture for the two years under consideration are given by E. Cooper (pp. 7–19), and a report of the deputy commissioner is presented by E. M. Ehrhorn (pp. 20–27).

A large part of the report is occupied with entomological matter, including an outline of entomology by J. Isaac (pp. 35–154); The Coccidæ of California, by E. K. Carnes (pp. 155–222); Insects of the Year, by E. M. Ehrhorn (pp. 223–230); The Codling Moth Parasite (pp. 231–235); The Gipsy and Brown-Tail Moths (pp. 236–238); and An Experiment in Silk Raising, by K. Kurosawa (pp. 261–270). After 2 years' experience with *Calicphialtes messer* as a parasite of the codling moth, a number of fruit growers speak of the work of this parasite in favorable terms, but its practical value is not yet established beyond question. Brief reports are made by the various county boards of horticultural commissioners regarding insect pests, fungus diseases, and the status of fruit growing (pp. 273–314).

The proceedings of the thirty-second State fruit growers' convention, held at Hanford, December 4–7, 1906, are included in the report (pp. 315–549). At these meetings popular addresses were given and articles read on various matters connected with the growing of fruit.

Sixth report of the State entomologist, W. E. BRITTON (*Connecticut State Sta. Rpt. 1906, pt. 4, pp. XII+219–306, pls. 15, figs. 13, map 1*).—The chief lines of work undertaken by the entomologist during the year are briefly discussed.

Considerable attention was given to nursery inspection, and a statement is made regarding the condition of nurseries, together with an account of the treatment of nursery stock by fumigation and other methods.

A determined effort is being put forth to gain control of the gipsy moth in Connecticut, which has slowly spread from Stonington, where it was first discovered. The methods adopted in the control of the gipsy moth are similar to those applied in Massachusetts. The Bureau of Entomology of this Department is cooperating with the State authorities in this work.

The entomologist has also made a study of the spiny-elm caterpillar and the insects which have been found injurious to the tobacco crop in the State. These include cutworms, wireworms, hornworms, flea beetles, grasshoppers, plant lice, cigarette beetles, etc. Notes are presented on fumigation houses and on the use of hydrocyanic-acid gas and carbon bisulphid for the destruction of insects. In spraying for the San José scale no injury was observed to buds or twigs from the use of lime-sulphur mixtures. Fairly good results were also obtained from the application of proprietary miscible oils, but the lime-sulphur mixture is recommended as being the cheapest and most effective.

First biennial report of the Wyoming State board of horticulture, 1905–6, A. NELSON (*Bien. Rpt. Wyo. Bd. Hort., 1 (1905–6), pp. 56, figs. 31*).—A statement is given of the organization of the horticultural board of Wyoming, with copies of the State horticultural law and the regulations of the board. Particular attention is devoted in this report to the requirements of the nursery law, its enforcement, and benefits. Considerable time has been spent by the secretary of the board in field work, explaining the purpose of the law, and awakening interest in the control of insect and fungous diseases.

Suggestions are given regarding the location of orchards and varieties to obtain the best results and on insects and fungus diseases which are recognized by the law. Formulas are also included for the preparation and application of insecticides and fungicides.

Insects new or unusual in Michigan, R. H. PETTIT (*Michigan Sta. Bul. 244, pp. 87–111, figs. 23*).—During the past few years a number of new insect pests have appeared in Michigan and well-known insects previously unimportant in the State have caused considerable damage. Biological and economic notes are given on these pests, including strawberry louse, cutworms, Mediterranean flour moth, greenhouse leaf tyer, wheat midge, strawberry-root worm, powder-post beetles, strawberry weevil, wheat jointworm, etc.

Report on the work of the section for plant protection, C. BRICK (*Hamburg. Bot. Staatsinst. Jahresber., 1905, pp. 24–39*).—During the year under report nearly 246,000 packages of fruit were imported through Hamburg, and of this number 239,000 came from America. Among apples, the Baldwin constituted 43 per cent of the total import. An examination for San José scale showed that 10 per cent of the fruit was infested. Notes are given on a number of other scale insects found on fruit and plants and on the injury caused by woolly aphis, cutworms, bark beetles, and other pests in the vicinity of Hamburg.

Entomology, H. S. LAWRENCE (*Ann. Rpt. Dept. Agr. Bombay, 1905–6, pp. 6–8*).—The locust plague has abated to a great extent, and it is not believed that serious depredations will be committed by these insects for some years to come. Particular attention is given to *Acridium succinctum* as well as to white ants, *Earias insulana*, etc. Mention is also made of the possibility of the accidental importation of cotton boll weevil.

Some injurious orchard insects, G. H. CARPENTER (*Dept. Agr. and Tech. Instr. Ireland Jour., 7 (1907), No. 2, pp. 243–249, figs. 5*).—Brief notes are given regarding the preparation and application of suitable insecticides for the control of codling moth, currant sawfly, plant lice, red spiders, scale insects, etc.

Catalogue of the Ephydridæ, with bibliography and description of new species, B. J. JONES (*Univ. Cal. Pubs., Ent., 1 (1906), No. 2, pp. 153–198, pl. 1, figs. 4*).—A list is given of the Ephydridæ collected in California, together with a bibliography of the subject, a description of a number of new species, and a catalogue of all known species, with a key for identification.

An investigation of evolution in chrysomelid beetles of the genus Leptinotarsa, W. L. TOWER (*Washington: Carnegie Inst. Washington, 1906, pp. X+321, pls. 30, figs. 31*).—For a period of about 11 years the author has studied the methods of evolutionary transformation in animals as illustrated by the members of the genus Leptinotarsa. A large part of the investigations were made on the Colorado potato beetle with particular reference to its geographical races.

A number of experiments were tried, during which it was found that deviations in temperature under which specimens of the Colorado potato beetle were kept acted simply in accelerating or retarding the pigmentation, and that the variations thus produced had no significance in subsequent generations. Data collected on the gradual distribution of the Colorado potato beetle in this country are of much value to students of this insect.

With regard to the bearing of his studies on evolution, the author concludes that the members of the genus Leptinotarsa, including the Colorado potato beetle, have undergone direct rapid transformations in response to environmental stimuli as a result of geographical dispersion.

The cabbage and onion maggots, J. B. SMITH and E. L. DICKERSON (*New Jersey Stas. Bul. 200, pp. 27, pls. 9, figs. 4*).—A series of experiments was car-

ried out with various cultural and remedial measures for the control of these two root maggots. Cultural methods include the destruction of rubbish about fields where the crops are grown and the disinfection of sheds or crates in which the crops are stored. It has been found better to plant the onion sets in late September or October rather than in August or early September. A good fertilizer should also be applied, and the ground should be kept thoroughly stirred about the growing plants, whether cabbage or onions.

Among the specific treatments applied to the control of these pests a mixture of carbolic acid and lime containing 1 tablespoonful of carbolic acid and enough lime to make a paste in a gallon of water gave the best results. Considerable benefit was also noted from the use of tarred paper cards about the plants and kerosene, powdered tobacco, white hellebore, and dry lime.

Where an infestation has already taken place, direct destructive measures may be used, such as carbon bisulphid, carbolic-acid emulsion, and a decoction of hellebore.

Two new pests of carrots, C. BÖRNER (*Arb. K. Biol. Anst. Land u. Forstw., 5 (1906), No. 5, pp. 282–292, figs. 11*).—In some localities considerable injuries are reported from the attacks of *Ceutorhynchidius terminatus* and *Phytomyza geniculata*, both of which are described in detail, with notes on their life history.

An insect pest of water cress, C. CATEUR (*Rev. Hort. Belge, 33 (1907), No. 1, pp. 14, 15*).—The larvæ of a fly (*Hydrellia ranunculi*) are reported as mining in the substance of the leaves of water cress, thus ruining their appearance and suitability for table use. No satisfactory remedy has been devised for the pest.

The spring canker worm, H. A. GOSSARD and J. S. HOUSER (*Ohio Sta. Circ. 65, pp. 7, figs. 8*).—The life history of spring canker worm is briefly outlined. In controlling this insect in orchards the fruit grower should depend chiefly on the proper application of bands and spraying with arsenate of lead or Paris green in Bordeaux mixture or in water.

Whitefly conditions in 1906. The use of the fungi, E. W. BERGER (*Florida Sta. Bul. 88, pp. 49–85, pls. 3*).—Parasitic fungi have been widely used in Florida in combating the whitefly. Success was had in 98 per cent of cases from spraying the spores of the fungi on trees or by attaching leaves carrying the fungus to trees. In this work the author used *Aschersonia aleyrodes*, *A. flavo-citrina*, the brown fungus, and *Sphaerostilbe coccophila*. The spores of the brown fungus have not yet been discovered, hence they can not be used in spraying on the trees. It has been found that in the other species the spores retain their vitality for a month, or perhaps longer.

All of the three first-named species of fungi thrive throughout Florida, but a humid atmosphere is essential for their growth. Apparently the best time for starting the fungi in trees infested with the whitefly is from May to August. Repeated plantings of the fungus should be made to insure success.

In badly infested localities it is recommended that trees along roadways should be trimmed high to avoid the distribution of the whitefly by carriages brushing against the branches. The whitefly feeds on a number of trees, including Cape Jessamin, chinaberry, umbrella tree, prickly ash, trifoliate orange, and others. Where these trees are of no value and infested they should be cut down and burned. If it is desirable to use insecticides against the whitefly, spraying or fumigation should preferably be done from December to February.

The gipsy moth and how to control it, L. O. HOWARD (*U. S. Dept. Agr., Farmers' Bul. 275, pp. 22, figs. 7*).—Historical notes are given on the distribution of the gipsy moth in Europe, its introduction into this country, and its

present distribution. The moth is now known to occur in Massachusetts, New Hampshire, Maine, Rhode Island, and Connecticut.

The insect is described in its different stages and notes are given on its injurious attacks, natural enemies, and artificial remedies. Some of the main features of the present Massachusetts law for the control of the gipsy moth are reproduced and a brief outline is given of the work of the Federal Government in this direction.

The California tussock moth, W. H. VOLCK (*California Sta. Bul. 183, pp. 189–214, figs. 17*).—*Hemerocampa vetusta* has been unusually injurious to apple trees in the Pajaro Valley and elsewhere in California during the past few years, especially in 1905. The damage was most severe where the egg masses had not been picked off and destroyed during the previous year. In orchards where this precaution was taken the loss was 23.5 per cent, as compared with 65.6 per cent in untreated orchards.

The pest in question lives on live oak, lupin, apple, and cherry trees as well as other plants. There is one generation annually. The egg masses are laid near buds and the larvæ burrow into the fleshy tissue or the fruit. The only parasites obtained by the author were tachina flies, but the eggs are attacked by a minute parasite.

Preliminary experiments showed that this insect is very resistant to arsenical poisons. The larvæ live for several weeks after feeding on foliage sprayed with arsenate of lead at the rate of 3 to 6 lbs. per 50 gal. of water. On account of the heavy coating of hair the caterpillars are difficult to kill by contact insecticides. Whale-oil soap killed some of them, but kerosene was apparently harmless. The best methods of control seem to be picking off the egg masses as soon as the leaves fall in the autumn and the use of sticky bands about the trunks of infested trees.

The San José scale problem in Ohio, 1906, A. F. BURGESS (*Ohio Dept. Agr., Div. Nursery and Orchard Insp. Bul. 8, pp. 30, pls. 7, figs. 3*).—As a result of his experience with San José scale in Ohio, the author recommends that all infested orchards should be carefully pruned and sprayed before the leaves appear in the spring. For large orchards lime-sulphur wash is considered best and cheapest, while in small city lots or on individual trees proprietary miscible oils give good results.

Report of remedies tested to control the San José scale and the codling moth, 1902 to 1906, A. F. BURGESS (*Ohio Dept. Agr., Div. Nursery and Orchard Insp. Bul. 9, pp. 36*).—Formulas are given for the preparation of the various insecticides which were used in combating San José scale and codling moth and the results obtained in the case of both insects are presented in a tabular form.

The author concludes that lime-sulphur wash made according to the formula 1–1–3 is the most satisfactory and cheapest insecticide which can be used against the San José scale. Thoroughness should be observed, however, in its application in order to protect fruit from becoming spotted with excessive infestation. The longer this treatment is continued the better the results which are obtained.

In spraying for codling moth it was found that the cost per tree averaged about 5 cts. when Bordeaux mixture and arsenate of lead were used in a mixture costing 1½ cts. per gallon. The author believes that the first spraying is the most important and the late July spraying next in importance. Little difference was observed in the effectiveness of the arsenical poison whether Bordeaux mixture was added or not. Arsenate of lead is considered more satisfactory than Paris green.

The value of ladybird larvæ, P. BOEKER (*Arb. K. Biol. Anst. Land u. Forstw., 5 (1906), No. 5, p. 282*).—*Coccinella septempunctata* was fed on plant

lice. It was found that during a period of 10 days each larva ate on an average 267 plant lice daily.

A fungus parasite of orange scale, L. Trabut (*Bul. Agr. Algérie et Tunisie, 13 (1907), No. 2, pp. 32, 33*).—An examination of diseased orange scales showed the presence of a number of parasitic fungi, among which was one which the author describes as new, under the name *Microcera parlatoriæ*.

The occurrence of Tomicus dispar on apple trees, G. Ihssen (*Prakt. Bl. Pflanzenbau u. Schutz, n. ser., 5 (1907), No. 2, pp. 14–18, figs. 2*).—Attention is called to a number of cases in which the attacks of this insect caused the death of infested trees. In such cases small holes were observed in the bark from the larger branches down to the base of the trunk. In combating this pest the author recommends the removal and destruction of infested branches and the planting of oak trees for trapping female beetles.

Acariosis of grapes, G. Scalia (*Acarosi della Vite. Catania: Monaco & Mollica, 1906, pp. 15*).—A disease of grapes is described in which the berries when nearly mature show a dirty white or grayish color and are covered with minute incrustations of a greenish or brownish color.

An examination of diseased grape berries showed the presence of a mite which was identified as *Glycyphagus spinipes*. This mite is described and notes are given on its biology. Since the mite may be found at some seasons of the year in the bark of the grapevine, it is suggested that all cuttings used for grafting should be scraped and treated if they are suspected of being infested and that infested trunks be treated with extract of tobacco or some similar insecticide.

Insects attacking the wood of grapevines, V. Mayet (*Rev. Vit., 27 (1907), Nos. 681, pp. 8–11; 682, pp. 36–40; 683, pp. 63–67; 684, pp. 98–102; 687, pp. 179–185, figs. 17*).—This is a practical article prepared for the use of vineyardists in combating insects which attack the stems of grapevines by boring or otherwise injuring them. The insects discussed in the article include species of Cicada, Cossus, white ants, tree crickets, Clytus, Agrilus, Apate, etc. Each species is described and notes are given on its habit and life history.

Bark beetles, O. Nüsslin (*Verhandl. Naturw. Ver. Karlsruhe, 19 (1905–6), pp. 49–64*).—A description is presented of the habits of some of the species of bark beetles with notes on their life history and the injury caused by their operations.

The generations of bark beetles, E. Knoche (*Ztschr. Forst u. Jagdw., 39 (1907), No. 1, pp. 49–53*).—The factors which influence the length of the life cycle of bark beetles are discussed with particular reference to *Tomicus typographus*.

Some insects injurious to forests. Additional data on the locust borer, A. D. Hopkins (*U. S. Dept. Agr., Bur. Ent. Bul. 58, pt. 3, pp. 31–40*).—This is a partial revision of part 1 of Bulletin 58 (E. S. R., 18, p. 159).

On the life history of Termes gestroi, E. P. Stebbing (*Indian Forester, 33 (1907), No. 1, pp. 6–12, pls. 2*).—*Termes gestroi* is proving to be a serious pest of the Hevea rubber tree. It appears that the white ants burrow under ground from one infested tree to another, producing tunnels through the trunk of the tree and hollowing it out from the crown of the root to a height of 7 ft. or more. In cases where an attack is made upon the bark from the outside, the surface of the trunk does not become covered with rubber as would perhaps be expected. On this account the author believes that the ants either eat or carry away the latex which exudes into their tunnels.

The utilization of cockchafers, K. Eckstein (*Ztschr. Forst u. Jagdw., 39 (1907), No. 1, pp. 44–49*).—In some localities where school children receive a small bounty for the collection of cockchafers, these insects have been collected

in enormous quantities and some attention has been given to their profitable utilization. It appears that they may be used for fertilizer, as a feed stuff, or in the preparation of axle grease.

Insecticides and fungicides, R. HARCOURT and H. L. FULMER (*Ontario Dept. Agr. Bul. 154, pp. 32*).—The purposes and necessity of spraying are briefly outlined and detailed formulas and explanations are given for the preparation and application of the standard insecticides and fungicides.

The lime-sulphur-salt wash and its substitutes, J. K. HAYWOOD (*U. S. Dept. Agr., Bur. Chem. Bul. 101, pp. 29*).—From experiments carried out with chemically pure lime and sulphur, it appears that solid sulphur is not dissolved by boiling 15 minutes, but that the best results are obtained by boiling from 45 to 60 minutes. A boiling period of 1 hour is sufficient to dissolve nearly all of the sulphur, but the thiosulphates are somewhat increased by a longer period.

Salt apparently has no influence upon the composition of the wash in so far as the sulphur compounds are concerned. The slight differences in the composition of the wash, as used by different investigators, have little or no influence upon the time required for boiling. When lime and sulphur are used in equal quantities there is more than enough lime to dissolve the sulphur. These substances may be used in the proportion of 1 lb. of lime to $1\frac{1}{4}$ lbs. of sulphur. About 25 lbs. of sulphur to 50 gal. is a maximum quantity.

It appears that the use of air-slaked lime has no influence on the composition of the wash, and that there is likewise practically no difference in composition whether flowers of sulphur or flour sulphur is used. Detailed notes are also given on the composition of lime-sulphur wash with particular reference to the different kinds of sulphur compounds. It is found that not all of the sulphur is dissolved by the heat generated by caustic soda, but the suggestion is made that a wash containing 10 lbs. of caustic soda and 19 lbs. of sulphur per 50 gal. of water without lime may give satisfactory results.

The use of arsenic in destroying injurious insects, A. RICHE (*Bul. Agr. Algérie et Tunisie, 13 (1907), No. 1, pp. 13–22*).—As a result of the study of this matter, it is recommended that soluble arsenical compounds should not be employed and that in all cases care should be exercised in the use of arsenicals so that they are prepared and applied in the manner recognized by entomologists and in accordance with laws regulating this subject.

Analyses of Paris green and lead arsenate, G. E. COLBY (*California Sta. Bul. 182, pp. 177–183*).—In 1901 a law was passed in California to prevent fraud in the sale of Paris green. Since that time about 73 tons of Paris green have been examined, of which $7\frac{1}{2}$ tons were rejected. The effect of the law was manifest in the improvement in quality of Paris green bought from New York manufacturers. At first only about 20 per cent of the Paris green was passable and during the fourth year of the operation of the law some laxity in the use of Paris green was again observed. Recently the station has recommended the more extended use of arsenate of lead in the place of Paris green.

The chemical test made at the station comprises the determination of the total arsenic and the quantity of free arsenious oxid. The results obtained by the determination of various samples of Paris green are shown in a tabular form.

Proposed insecticide law, C. W. WOODWORTH (*California Sta. Bul. 182, pp. 184–186*).—In order to bring about further improvement in the quality of Paris green, the text of a proposed law is given worded essentially the same as the law for the control of commercial fertilizers with only such verbal changes as are necessary to make it apply to insecticides.

Animal pests and legislation, F. V. Theobald (*Proc. Assoc. Econ. Biol., 1 (1906), No. 2, pp. 29–74*).—Attention is called to the general recognition of the necessity of legislation for the control of insect pests. Examples are given of insect enemies of crops, animals, and man, and of legislation which has been adopted in controlling these pests. A considerable proportion of the article is occupied with copies of some typical laws relating to injurious insects in England, various English colonies, and in the United States.

First report of the State beekeepers' association of Pennsylvania, H. A. Surface (*Penn. Dept. Agr. Bul. 148, pp. 57, pls. 2*).—The Pennsylvania State beekeepers' association was organized in 1904 and held its first annual convention in Harrisburg, December 6 and 7 of the same year. The first annual meeting was held in Harrisburg, December 6–7, 1905, and the present bulletin contains an account of the meeting with copies of some of the papers read. The subjects discussed include the importance of fostering apiculture, the habits of honeybees, foul brood and other diseases, the relation between bees and horticulture, methods of improving honeybees, and notes on honey plants.

Honeycomb, R. Pincot (*Apiculteur, 51 (1907), No. 2, pp. 52–60, fig. 1*).—The author recommends that every bee raiser should own an apparatus for manufacturing comb foundation and should make his own foundation. In this way considerable expense is avoided and the purity of the foundation can be assured.

Disinfecting mulberry leaves before feeding to silkworms, U. Zanoni (*Bul. Agr. [Milan], 41 (1907), No. 2, pp. 1, 2*).—Mulberry leaves were fed in a natural state and after disinfection with silver fluorid (1 : 100,000) or sulphate of copper (1 : 10,000). It was found during these experiments that while the cocoons of silkworms fed on disinfected leaves weighed slightly more, the amount of available silk was no greater and the advantage of the treatment was, therefore, altogether in favor of the silk raiser.

FOODS—HUMAN NUTRITION.

Food products, A. L. Winton (*Connecticut State Sta. Rpt. 1906, pt. 2, pp. 107–166*).—Of 2,361 samples of food materials examined, 678 were found to be adulterated or below the standard, 93 were compounds, and 1,457 were not found to be adulterated.

The materials examined included chocolate candy, coffee and coffee substitutes, dairy products, flavoring extracts, cream of tartar, sugar, maple sugar and sirup, culinary fats and oils, sausage and similar goods, oysters and fish, spices and condiments, honey, vinegar, starch, etc.

Two of the 362 samples of milk collected by the station contained borax, 9 samples were watered, and 6 were considerably below the standard and unfit for sale as standard milk. Of the 116 samples collected by health officers, 7 were unquestionably watered, 5 were skimmed, and 47 were below standard. One sample contained formaldehyde.

Twenty-five samples of cream were examined, and of these 1 contained boric acid and 1 was below standard as regards fat content.

Analyses of 8 brands of condensed milk showed that only 4 contained over 28 per cent of solids, or, in other words, had been evaporated sufficiently to conform to the legal standard.

"The common adulteration of condensed milk consists in using skimmed milk instead of whole milk for its preparation. Watering of the original milk is a disadvantage to the manufacturer, as it necessitates longer evaporation, and the use of preservatives is unnecessary when the product is thoroughly sterilized

and packed in hermetically sealed cans, although they might serve to keep the milk previous to evaporation or after opening the cans."

Of 16 samples of "butter" tested, 3 were natural butter, 3 renovated butter, and 10 oleomargarine or butterine.

Two culinary fats which purported to be corn products were found to contain cotton-seed oil, "but the characteristic constituent appears to be corn (maize) oil stiffened with a harder fat, such as stearin."

Forty-three of the 135 samples of lard examined were compound and 3 were thus marked.

In the case of olive oil, 14 of the 110 samples examined were adulterated and 2 were compounds. Eleven samples consisting of cotton-seed oil "were labeled salad oil, and are therefore technically compounds."

Tests for preservatives in 88 samples of pork sausage showed that 40 contained boric acid or borax and 36 sulphurous acid. Borax was not found in any of the 21 samples of Hamburg steak examined, but 12 samples contained sulphurous acid. Only one of the 19 samples of oysters examined contained boric acid, but this preservative was found in 14 of the 16 samples of codfish submitted to the station.

A special study was made of diabetic foods, including flours and meals, bread, biscuits, rusks, etc.; nut butter and similar goods; diabetic cocoa and baking powder; macaroni; homemade gluten meal biscuit; and soy-bean biscuit. All of the commercial wheat preparations contained a certain amount of starch, although in most of them the normal percentage was considerably reduced. "The beneficial results from their use is not due solely to the reduced percentage of starch, but also to the increased percentage of protein." The percentage of protein in nearly every case was found to fulfill the claims made by the manufacturers.

"A safe flour for those suffering with the disease is casein flour entirely free from carbohydrates or else a vegetable flour containing the smallest possible amount of these substances, such as may be prepared from soja beans by simply grinding with removal of the hulls, from almonds and other starch-free nuts after expressing a portion of the fat, or from wheat after washing sufficiently to remove nearly all the starch. A guaranty as to protein and starch content should be furnished with each product, so that physicians can calculate dietaries for their patients."

A number of the special diabetic foods did not show any very decided advantage over ordinary wheat flour for diabetic patients when judged by analysis, and microscopical examination "proved that all of them contained large amounts of wheat starch with no marked difference from that of wheat flour."

"In making out dietaries for diabetic patients it should be borne in mind that starch, sugar, and dextrin are all about equally injurious, since starch and dextrin are converted by the saliva and pancreatic juice into sugar (chiefly maltose), and it is the sugar, not the starch itself, which is directly injurious. For example, changing a portion of the starch into dextrin, as is done to some extent by toasting bread, does not render it less injurious, in fact it actually hastens the formation of sugar through the action of the digestive juices, since dextrins are intermediate products in the change. For this reason the sum of the percentages of starch, sugar, and dextrin, and not the starch alone, should be considered in valuing diabetic preparations."

"The peanut, another leguminous seed, although very rich in oil, contains about 11 per cent of starch, sugar, and dextrin, of which about half is starch.

"Most of the nuts, including walnuts, Brazil nuts, almonds, and filberts, since they contain no starch and only small amounts of sugar and dextrin,

but are rich in protein and oil, are valuable additions to the diet of diabetics. Almond meal is used in the preparation of various biscuits and bread substitutes. The chestnut is a notable exception among nuts, in that it is rich in starch and poor in fat, the composition of the shelled nut being much the same as that of wheat flour; it is therefore entirely unsuited for the use of diabetics."

Food legislation during the year ended June 30, 1906, W. D. Bigelow (*U. S. Dept. Agr., Bur. Chem. Bul. 104, pp. 53*).—This summary of legislation on food in the different States and Territories supplements the compilation of such data previously referred to (E. S. R., 17, p. 891).

Foreign trade practices in the manufacture and exportation of alcoholic beverages and canned goods, H. W. Wiley (*U. S. Dept. Agr., Bur. Chem. Bul. 102, pp. 45, pls. 2, figs. 5*).—The author visited some of the principal regions in Great Britain and Ireland, Germany, and France where whisky, wine, and brandy are produced, and some of the French vegetable and sardine canneries, with the special object of securing data on the preparation, preservation, and character of the products mentioned, as offered for importation into the United States, in order that just and effective standards might be adopted for their inspection on arrival at American ports.

As regards the preparation of canned sardines, it was found that it is customary in French canneries to heat the fish in peanut oil previous to packing in olive oil. This is regarded as one of the reasons why peanut oil has been discovered in so many packages of sardines which were labeled "Packed in pure olive oil." "There is no objection to the use of peanut oil for the purpose mentioned, but where the packages are labeled 'Packed in pure olive oil,' it is held that peanut oil should not occur, or at least only in mere traces."

The new meat inspection law and its bearing upon the production and handling of meats, G. P. McCabe (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 101, pp. 16*).—In an address delivered before the New York State Breeders' Association at Syracuse the author discussed the principal provisions of the United States meat inspection law, the manner in which the provisions are enforced, and the bearing of the law upon the production and handling of meats.

"To secure the best results, the breeders and feeders of every State in the Union should take up vigorously the question of the extension of markets and should back the Department of Agriculture in an insistent demand for an absolutely efficient, vigilant, fair, and square meat inspection. . . . If a due regard be had for cleanliness, decency, and honesty in the preparation and marketing of our meat products, the United States will continue to lead the world in the live stock and meat trade."

Concerning meat extract, E. Baur and H. Barschall (*Arb. K. Gsndhtsamt., 24 (1906), No. 3, pp. 552–575*).—Among the conclusions drawn from the investigations reported were the following:

Succinic acid is a normal constituent of meat extract and its presence does not depend upon the action of an acid. Small quantities of aspartic acid and grape sugar, when heated in an autoclave, were found to yield succinic acid, and apparently aspartic acid may be looked upon as the source of succinic acid in meat extract. At any rate, succinic acid in meat extract is not due to decomposition.

By means of Jaffé's reaction, creatin and creatinin may be determined quantitatively in meat extract and peptones. Amino acids are present in meat extract, and peptones and determinations are reported of the creatin, creatinin, and amino acids in a number of commercial products.

The hydrolysis of meat extract, II, K. Micko (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 12, pp. 705–729*).—The principal body identified was glutaminic acid, and in addition alanin, glycolucin, aspartic acid, and glycocoll,

as well as other amino-acids which it is not possible to identify. (See also E. S. R., 17, p. 683.)

Concerning crab extract, I, D. ACKERMANN and F. KUTSCHER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 4, pp. 180–184*).—The authors have identified considerable amounts of tyrosin, leucin, arginin, and lysin in crab extract. No creatin and creatinin were found, and in general it appears to be the case that these bodies are not present in flesh extractives at the same time as arginin and lysin.

Crab extract, A. RÖHRIG (*Ber. Chem. Untersuch. Anst. Leipsic, 1905, p. 11; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 9, pp. 559, 560*).—An analysis of commercial crab extract is reported.

Sardine paste, P. BUTTENBERG *and* W. STÜBER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 6, pp. 340–344*).—Analyses were made of sardine paste, anchovy, and similar goods with a view to securing data for judging the purity of such products.

Concerning the composition of goose eggs, A. SEGIN (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 3, pp. 165–167*).—Data are given regarding the weight of the entire egg—yolk, white, and shell—as well as the proportion of ether extract, protein, and phosphorus constituents in goose eggs. According to the author, the data show that the total phosphoric acid and lecithin phosphoric acid in goose-egg yolk is somewhat smaller than in the case of hen and duck eggs. The proportion of free lecithin is about midway between that in the hen's and the duck's egg. The proportion of lecithin in combination is somewhat higher than in the duck's egg and lower than in the hen's egg.

Studies of gelatin and glue, P. BUTTENBERG and W. STÜBER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 7, pp. 408, 409*).—Determinations of the sulphurous and sulphuric acid in a number of samples of gelatin and glue are reported. Apparently all the samples of powdered and sheet gelatin had been treated with sulphurous acid in the process of manufacture, as they contained sulphurous and sulphuric acid. Carpenters' glue, on the other hand, was free from sulphurous acid and contained only a little sulphuric acid.

The investigations were undertaken with a view to securing data regarding the estimation of added gelatin in canned goods.

The food value of vegetable gelatins (*Jour. Amer. Med. Assoc., 48 (1907), No. 2, pp. 142, 143*).—A summary of data on the use as food of Iceland moss, Irish moss, agar-agar, and Japanese algæ.

It is pointed out that jellies and other dishes made from these materials are often used in invalid dietetics and in other ways, and are commonly assumed to have a high food value. According to the data summarized, the carbohydrates, the chief food constituents which they contain, are not digested by man, and so they have little or no nutritive value.

"On account of their marked property of holding large quantities of water, relatively small quantities of vegetable jellies cause the elimination of copious watery feces. As they form agreeable articles of diet when used like gelatin as a vehicle for fruit juices and other flavors, it is suggested that agar-agar or the moss jellies may be of value in certain cases of constipation."

Concerning the manufacture and composition of Chinese bean cheese (Teou-Fou) from Soja hispida, BLOCH (*Bul. Sci. Pharmacol., 13 (1906), pp. 138–143; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 9, pp. 564, 565*).—The method of manufacturing soy-bean cheese in China is described.

After soaking for 8 or 10 hours the beans are ground, rubbed up with water, and pressed. The resulting liquid is strained through cloth and slowly heated to the boiling point. The bean cheese is then precipitated, pressed, and cut into

small cakes. It is stated that 6 kg. of soy beans will yield 80 liters of liquid, from which 20 to 25 kg. of bean cheese may be precipitated. The pressed cake from this quantity of beans would weigh 13 kg., and is generally used as cattle fodder, though it is not infrequently eaten by poor people.

According to analyses the bean cheese contained 83.85 per cent water, 1.296 per cent nitrogen, 4.33 per cent fat, and 0.57 per cent ash, and the pressed cake 88.75 per cent water, 0.248 per cent nitrogen, 0.04 per cent fat, and 0.36 per cent ash.

Banana flour, A. Röhrig (*Ber. Chem. Untersuch. Anst. Leipsic, 1905, p. 31; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 9, p. 564*).—An analysis is reported of banana flour from Central or South America.

The fat of sorghum seed, N. Andrejew (*Vyestnīk Shirov. Veshch., 4 (1903), pp. 186–188; abs. in Ztschr. Untersuch. Nahr. u Genussmtl., 10 (1906), No. 12, p. 617*).—A study of the fat of *Sorghum cernuum* was made, this seed, in the author's opinion, being a satisfactory food for both man and animals.

Sorghum-seed fat is yellowish in color and not unlike yellow vaseline in appearance, but of somewhat harder consistency. Oleic, reisinoleic, linoleic, and erucic acid were the principal acids present. It resembles oat fat in its combination of erucic acid with oleic acid, and maize fat in that linoleic acid is present. The latter acid accounts for the slow drying properties observed in sorghum-seed fat and the proneness of the meal to fermentation. Valeric, formic, and other volatile fatty acids were identified.

The melting point of sorghum fat is 39 to 40 degrees; the iodin number and other constants are reported.

Chinese bean oil, W. Korentschewski and A. Zimmermann (*Vyestnīk Obshch. Hig., 5 (1905), pp. 690–693; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1906), No. 12, p. 616*).—As shown by studies of 4 samples of Chinese soy-bean oil, which is much used in the Orient as a food material, the melting point is 20 to 21 degrees and the saponification number 207.9 to 212.6. Other constants are reported. The samples examined were all liquid, dark brown in color, and resembled plant oils in flavor.

The digestibility was studied with 3 soldiers, 100 gm. being taken per man per day in addition to the regular ration with about 46 gm. of other fat. The coefficient of digestibility was 95 per cent in round numbers. The conclusion was reached that fresh Chinese bean oil is very thoroughly assimilated.

Cocoa and chocolate, H. Beckurts (*Arch. Pharm., 244 (1906), No. 7, pp. 486–516*).—With a view to the establishment of standards for cocoa and chocolate available data are summarized and discussed. Among the recommendations which were made are the following:

Cocoa mass, cocoa powder, cocoa with the fat removed, soluble cocoa, and similar products, according to the author, should contain no foreign plant substances, as starch of flour, and no foreign mineral matter or fat, and cocoa shells should be removed as far as possible. The cocoa mass should contain on an average 52 to 56 per cent fat and 3 to 5 per cent ash.

Chocolate should not contain added materials with the exception of flavoring matter. If the sugar content is over 66.5 per cent, chocolate should be declared "very sweet." The recommendations also take into account the use of chocolate in confectionery and in the preparation of dietetic articles and medicines.

The pentose content of cocoa beans and its relation to the detection of shell in ground cocoa, H. Lührig and A. Segin (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 3, pp. 161–164*).—The experimental data led the authors to conclude that more information is needed before variations in the

pentose content can be relied upon for the detection of adulteration of powdered cocoa with cocoa shells.

The proportion of caffein in coffee and its estimation, P. Wäntig (*Arb. K. Gsndhtsamt., 23 (1906), pp. 315–332; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 7, p. 430*).—According to the data reported, a cup of coffee measuring 150 cc. made with 300 gm. of water and 15 gm. very finely ground coffee contains, on an average, from 0.06 to 0.1 gm. caffein.

Concerning the sugars in spices. I, White cinnamon, J. Hanuš and F. Bein (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 7, pp. 395–407*).—The conclusions which were drawn follow:

The pentosan content of spices is fairly constant and depends upon the portion of the plant from which the spice is obtained. White cinnamon contains a larger amount of pentosans than spices obtained from the whole plant or from leaves. In accordance with the results of early investigators, mannite was identified in the spice studied. Arabin and galactan, as well as small quantities of xylan, were dissolved by water under pressure. The insoluble portion of the spice contained xylan and probably glycosan.

Concerning spices. II, Allspice, cloves, and cardamom, R. Thamm (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 3, pp. 168–172*).—Special studies of the ash constituent of spices are reported, particularly the degree of alkalinity of the ash.

Notes on pepper, C. Hartwich (*Ztschr. Untersuch. Nahr. u. Genussmtl., 12 (1906), No. 9, pp. 524–530, figs. 4*).—Determinations of the weight of pepper berries are given, as well as notes accompanied by drawings regarding pepper adulterants.

Discoloration of fruits and vegetables put up in tin, F. A. Norton (*Jour. Amer. Chem. Soc., 28 (1906), No. 10, pp. 1503–1508*).—According to the author, the discoloration often observed on the can or can contents when fruits and vegetables are preserved in tin is due to the action of sulphids on the heavy metals. If the foods decompose in the can hydrogen sulphid may be liberated from protein by the action of the micro-organisms. Laboratory experiments showed that it may also be produced from food proteids by the action of heat under pressure. The use of an excess of flux in soldering or a poor grade of solder is likewise a condition which favors discoloration, as the action of the fruit or vegetable juice is thereby increased.

"Sulphites should not be used with goods of an acid character which are to be put up in tin. Where a heavy process is necessary, care should be exercised to avoid the use of an excess of flux or the use of low-grade solder or tin plate, which would tend to increase the amount of heavy metals taken up by the goods. Also the length of the process, in order to avoid evolution of hydrogen sulphid, should be as short as possible, consistent with complete sterilization of the goods."

The presence of formalin in foods, G. Perrier (*Compt. Rend. Acad. Sci. [Paris], 143 (1906), No. 17, pp. 600–603*).—The possible occurrence of formalin in smoked food products is pointed out and determinations reported of the amount present in a number of products; for instance, 0.03 to 1.20 mg. was found per 100 gm. in ham and 0.04 to 0.6 mg. per 100 gm. in smoked sausage. The necessity of taking into account in pure-food legislation the occurrence of formalin under such circumstances is pointed out.

Food of the natives of India, G. H. Fink (*Jour. Trop. Med. [London], 9 (1906), No. 20, pp. 310–312*).—On the basis of experience the author discusses the diet of the native population in different parts of India. The high esteem in which milk is held by the native population and the importance of sugar in

the diet are among the questions spoken of. He states that milk boiled for a considerable time and sweetened with large quantities of either white or brown sugar is much used, as well as sour milk, cream, curds, and clarified butter.

According to the author, "it is erroneous to suppose that the whole of the natives of India are vegetarians, in the strictest sense of the term. This idea seems to have gained acceptance from the fact that the wants of the natives, chiefly the Hindoo population, are few and simple, and that they confine themselves to the actual necessities of life in the matter of food."

The Mahomedans "consume more flesh than the Hindoos, and are permitted to eat either fish, fowl, mutton, or beef. Even the poorer class of Mahomedans eat more animal food than the Hindoos, but in some parts of India Hindoos are quite as strong on animal food (mutton and fish) as Mahomedans. The strictest vegetarians are the Jains, a sect of which a great many of the mercantile caste of Upper India are members."

"If we analyze the various kinds of food in use in India by the rich as well as the poor, we can not help coming to the conclusion that, on the whole, the food is fairly well balanced in the matter of the elementary principles of the diet of both Hindoos and Mahomedans. The Hindoos, though largely vegetarians, live on food rich in carbohydrates and hydrocarbons, but they are at the same time large consumers of milk and those products of milk which are healthful and nourishing [as well as legumes, particularly lentils. Fish and mutton are also eaten by the Hindoos]. In Bengal and Assam, fish supplies largely the nitrogenous element, while in other parts of India fish and mutton are used. The Mahomedans, who form about the fifth of the total population of India, live on very similar food to the Hindoos; eat less sweetmeats, but more animal food (mutton, beef, and goat's flesh). Their food, on the whole, contains a larger proportion of the nitrogenous principle than that of the Hindoos."

A number of the sects are not considered in this paper because the author states that their diet conforms more closely to western standards.

Studies of the development of the proletariat in North America, W. SOMBART (*Arch. Socialwiss. u. Socialpolitik, 21 (1905), pp. 556–611; abs. in Hyg. Rundschau, 16 (1906), No. 21, pp. 1204–1206*).—Considerable attention is devoted in this article to the food of workingmen's families in America, and a comparison is made between the kind and amount of food eaten in America and elsewhere. In the author's opinion, the American workingman lives better than the German.

Diet in boarding schools, J. O. SYMES (*Jour. Roy. Sanit. Inst., 27 (1907), No. 12, pp. 767–771*).—The subject is discussed with special reference to conditions in Great Britain. The author insists upon the need of an abundant diet of palatable well-cooked food.

"Digestion depends chiefly upon appetite, and appetite is excited by the organs of sight and smell, and by pleasant mental impressions. It is important, therefore, that food at school should be cooked carefully and served daintily. There should be as little as possible of routine in school fare, and everything should be done to discourage children rushing their meals in order to get to work or to play."

Suggestions are made regarding the character of the different meals and related matters.

Studies of children on a vegetarian diet, H. ECKHARDT (*Zentbl. Gesam. Physiol. u. Path. Stoffwechsels, n. ser., 1 (1906), No. 20, pp. 617–622*).—The studies were made at a so-called vegetarian home in Breslau. The diet, more

properly speaking, should be called lacto-vegetarian, as milk, butter, cheese, eggs, and honey were eaten as well as vegetable foods.

In addition to dietary studies with 3 children from 5 to 7 years old, the balance of income and outgo of nitrogen was determined. In the first two tests there were gains of 2.23 and 1.56 gm. nitrogen per day on a diet furnishing respectively 8.97 and 5.36 gm. of nitrogen. The energy supplied per kilogram per day was 104.6 and 100 calories respectively. In later tests there were gains of 0.47 and 0.65 gm. nitrogen per day respectively on an income of 4.70 and 5.30 gm. The energy supplied per kilogram per day was 70.8 and 89.2 calories.

As pointed out by the author, the diet supplied at the institution did not differ materially from the so-called mixed diet of the region, and was, indeed, doubtless more generous, as most of the working people live on vegetable foods, with some milk, and very seldom have meat.

The results are discussed in comparison with those obtained by other investigators.

A dietary study of five halls of residence for students in Edinburgh, I. D. Cameron (*Proc. Roy. Soc. Edinb., 26 (1905–6), No. 5, pp. 327–351*).—The dietary studies were made in 4 men's clubs and 1 woman's club and were each of 1 week's duration, a total of 119 men and 60 women being included.

The diet on an average supplied 143 gm. protein, 138 gm. fat, and 511 gm. carbohydrates, the fuel value being 3,979 calories. The average cost of the food per man per day was 30 cts. Animal protein constituted 63 per cent of the total and animal food made up 66 per cent of the entire cost. The waste varied considerably, its approximate cost being from 2.4 per cent to 7 per cent of the total sum expended for food.

Metabolism on insufficient diet, I–IV, F. N. Schulz, E. Mangold, H. Stübel, and E. Hempel (*Arch. Physiol. [Pflüger], 114 (1906), No. 9–10, pp. 419–486, fig. 1*).—Investigations carried on by Schulz's students are reported and summarized. The principal conclusions follow:

The experimental data furnish additional demonstration of the fact that the organism of a fasting dog can lose so much fat that the metabolism of protein is increased. On insufficient diet the total metabolism may be reduced to half the normal. Fasting induces disturbances which can not be attributed to a lack of energy-yielding food or to the fact that no more body protein can be spared, but which are apparently caused by a kind of auto-infection. These disturbances disappeared when a small amount of food was supplied.

Additional experiments are needed to study the many conditions which affect nitrogen metabolism in fasting.

Problems in animal metabolism, J. B. Leathes (*London: John Murray, 1906, pp. 205; rev. in Pub. Health [London], 19 (1907), No. 5, p. 327*).—This course of lectures, delivered at London University, summarizes recent investigations and older work in metabolism and discusses available data with reference to various problems concerned with health and disease.

The effect of consuming different amounts of calcium and magnesium upon the metabolism of these constituents and the quantities present in the animal body, S. Gorrien (*Arch. Physiol. [Pflüger], 115 (1906), No. 1–2, pp. 118–151*).—According to the investigations (which were made with rabbits) an abundance of calcium and magnesium in the diet induces a storage of these constituents in the body while a deficiency of calcium and magnesium lowers the body store. The changes are especially noticeable in bones and the muscular system. The variations in magnesium content of the other organs is particularly small.

The value of resistant or negative work in animal dynamics, J. LEFÈVRE (*Compt. Rend. Acad. Sci. [Paris], 143 (1906), No. 20, pp. 757–760*).—The author discusses resistant or negative work—that is, the work expended—for instance, in walking downstairs as compared with positive work or that expended in walking upstairs. According to his calculations, this negative work is equal to one-half of the corresponding positive work.

Lessons on elementary hygiene and sanitation with special reference to the Tropics, W. J. PROUT (*London: Waterlow & Sons, 1905, pp. 159, illus.; rev. in Brit. Med. Jour., 1906, No. 2406, p. 322*).—In this volume, which was printed for the colony of Sierra Leone, water, food, dwellings, and personal sanitation are among the topics considered.

The hygiene of the intestines, E. METCHNIKOFF (*Rev. Gén. Sci., 17 (1906), No. 20, pp. 899–906*).—The dangers which may result from the passage of bacteria through the intestinal walls and from the presence of bacteria and parasites in the intestines are pointed out and the importance of sterile and clean food insisted upon. Special reference is made to the dangers which may attend the use of uncooked vegetables, fruit, oysters, and other food materials.

Putrefactive fermentation in the intestine, R. BAUMSTARK and L. MOHR (*Ztschr. Expt. Path. u. Ther., 3 (1906), No. 3, pp. 687–690*).—According to the observations reported, putrefactive processes, as shown by the excretion of ethyl-sulphuric acid and indican, continue in fasting as long as hunger feces are retained in the intestine. After the excretion of such feces no indican was found in the urine. This is an additional proof that indol formed in the intestine is the sole source of renal indican and that it is not formed by the cleavage of body protein during fasting.

Estimating the specific gravity of feces, H. STRAUSS (*Zentbl. Gesam. Physiol. u. Path. Stoffwechsels, n. ser., 2 (1907), No. 2, pp. 49–52*).—A pyknometer suitable for use in determining the specific gravity of feces is described and the method of making such determinations outlined.

ANIMAL PRODUCTION.

Commercial feeding stuffs (*Die Futtermittel des Handels. Berlin: Paul Parey, 1906, pp. VIII+1191, pls. 29, figs. 135*).—This volume comprises papers by a number of authors summarizing available data on composition, digestibility, adulteration, and related questions with reference to the principal commercial feeding stuffs. These papers are reprinted from *Die Landwirtschaftlichen Versuchs-Stationen* for 1900 and later, and have been noted as they have appeared. The volume contains a preface by O. Kellner and an index compiled by M. P. Neumann.

Commercial feeding stuffs, E. H. JENKINS and A. L. WINTON (*Connecticut State Sta. Rpt. 1906, pt. 3, pp. 169–218*).—The feeding stuffs examined under the State law included cotton-seed meal, cotton-seed feed, linseed meal, rapeseed meal, entire wheat meal, wheat bran, wheat middlings, mixed wheat feed, maize meal, gluten feed, hominy feed, rye feed, ground oats, buckwheat middlings, malt sprouts, gluten feed, dried distillers' grains, dried brewers' grains, miscellaneous mixed and proprietary feeds, special poultry feeds, meat scrap and ground bone, condimental cattle feed, corn silage, and corn for ensiling.

As a whole, the results show fewer discrepancies between guaranteed and actual composition than formerly, and the authors state there seems little evidence of any desire on the part of the manufacturers to deceive the public regarding the quality of feed.

"There are, however, a good many feeds offered for sale . . . which could

not be sold to feeders who apply a fair knowledge of the art of feeding stock and business methods to the buying of their feed."

The buyer should study the market price and composition of commercial feeds and make his selection accordingly.

"Cotton and linseed meals, the gluten and wheat feeds, distillery and brewers' grains, and a few other standard things supply digestible protein at reasonable prices. They are all that any feeder needs to supplement and balance the hay, silage, stover, and corn meal which his farm produces. They are the only commercial feeds which will supplement them. It is absolutely impossible to balance the feed which the farm produces with boughten feed containing less than 15 per cent of protein, which is more than many of these commercial feeds contain. On a well-managed farm there is no need to buy starchy feeds nor a single oat hull nor any chaff."

The substituting value of different feeding stuffs, L. Duclert (*Bul. Mens. Off. Renseig. Agr. [Paris], 5 (1906), No. 12, pp. 1488–1494*).—The author has calculated and arranged in tabular form data which show amounts of different feeding stuffs equivalent in nutritive value, with special reference to the feeding of horses and ruminants.

Feeding cellulose and coarse fodders to herbivorous animals, V. P. Ustyantzev (*O Pītaniī Travoyadnuikh Zhīvotnuikh Klyetchatkoĭ ī Ghrubuimī Kormami. Kiev: 1906, pp. VII+174*).—Experiments with sheep and rabbits were undertaken to determine the feeding value of wheat straw before and after a treatment which would remove a greater or less amount of the incrusting material present. In some of the experiments with rabbits the respiratory products were taken into account, a Pashutin respiration calorimeter being used.

According to the author's summary, winter wheat straw when fed to sheep has a low nutritive value, and when fed to rabbits its value is negative. On the other hand, cellulose from the same straw freed from incrusting substances has a decided food value and is equal to isodynamic quantities of starch and sugar as protectors of protein and fat. When fed to either rabbits or sheep, it is almost completely digested. Even if the incrusting substances are only partially removed the value of the coarse fodder is decidedly increased, but the maximum effect is not obtained unless the fodder is entirely freed from such constituents.—P. FIREMAN.

Investigations on the protein sparing action of asparagin, M. Müller (*Arch. Physiol. [Pflüger], 112 (1906), No. 5–6, pp. 245–291, pls. 3*).—Experiments with bacteria from the paunch of ruminants showed that they select asparagin in preference to protein as nutritive material. The author concludes, therefore, that asparagin serves as a protector to protein and that these bacteria have the power to synthesize nitrogenous bodies of higher molecular structure from asparagin and from ammonium tartrate. The bodies formed give the same reactions as peptone and pure albumen. The author believes that the results noted in vitro are applicable to the animal body.

New experiments on the source of hippuric acid in the animal body, H. Vasiliu (*Mitt. Landw. Inst. Breslau, 3 (1906), No. 5, pp. 829–866*).—According to the author's investigations, benzoic acid derived from plant proteids by oxidation is to be regarded as the source of hippuric acid in the animal body. The leaves and fruits contain a larger proportion of the mother substance than stems and roots, and the older the plant the smaller the amount in leaves, stems, and roots. The mother substance is inversely proportional to the crude fiber and pentosan content and directly proportional to the protein content.

Incrusting substances, such as lignin, can not be regarded as the principal

depositories of the hippuric acid yielding material. When a feeding stuff is oxidized benzoic acid is derived chiefly from phenyl alanin. Only a small part of the unhydroxylized benzin of phenyl alanin undergoes cleavage and oxidation in the body in the case of herbivora, and the greater part reappears in the urine as hippuric acid and as phenyl alanin. In the case of man and very probably of carnivorous animals also the reverse is the case, and only a very small amount is excreted in the urine as phenyl alanin. In this case phenyl alanin plays very little part in the formation of hippuric acid. The greater part of the unhydroxylized benzin ring of proteids undergoes cleavage and combustion in the human body and probably in the case of carnivora also, only a small portion being excreted as hippuric acid in the urine or undigested in the feces.

Stable ventilation, purpose, scope, and need for such work, M. H. Reynolds and C. C. Lipp (*Minnesota Sta. Bul. 98, pp. 87–120, figs. 8*).—The authors preface the account of their own investigations with a summary of the available data on the subject of stable ventilation and a discussion of the need for work along this line. The investigations reported were undertaken to determine how little air is compatible with normal health and comfort of live stock and with economical feeding in northern climates during midwinter, as obviously the question of stable ventilation during the summer is a matter which requires little consideration.

The experiments reported varied in length from 6 hours to 37 days, and a tightly closed stable of special construction provided with openings through which food and water could be supplied without admitting any appreciable quantity of outside air was used. For purposes of comparison, steers were also kept in an open stall. The amount of carbon dioxid in the air reached as high as 2.67 per cent. Ordinarily when the closed-stall conditions were very bad it would range from 0.52 to 1.09 per cent. Frequently the proportion of carbon dioxid would increase during varying periods to a maximum, and then either remain constant or decrease without added ventilation. The relative humidity of the air varied up to 99 or practical saturation. Moisture would gather freely on the ceiling and walls of the stable and would sometimes run down in small streams. "It is scarcely possible to imagine a stable where more unsanitary conditions according to accepted standards are maintained than in this stall."

Samples of blood and urine were taken for analysis at regular intervals. In the case of the blood the red and white corpuscles were counted and the hemoglobin content, the period of coagulation, and the specific gravity were estimated. Analyses and other studies were made with the urine, but all these analytical data are reserved for further publication.

The results obtained, according to the authors, show the great adaptability of the animal organism, a fact which has been pointed out by earlier investigators.

"The only records materially varying in a long series of averages as between open and closed stall conditions, as stated for the closed stall, were: Pulse slightly increased, respiration slightly increased, average period for blood clotting materially increased. Changes in the red and white blood cell counts were not uniform and the results are given no special significance. . . .

"When animals were confined in a slowly contaminated atmosphere there was no appreciable effect, even though the atmosphere varied very widely from a normal air and contained large proportions of substances which have been supposed to be actively injurious.

"One steer was confined in the closed stall for 37 consecutive days and seemed to be in perfect comfort, showing every symptom of being at ease, and there

were no variations from the normal that could be detected by laboratory and clinical methods used."

The moisture content of the stable air was often excessive.

Tentative conclusions were drawn from the experiments as follows:

"Historical statements concerning the unwholesomeness of badly crowded and unventilated stables are conceded to be in the main correct as to actual facts, but the accepted explanations may be seriously questioned.

"When animals confined in unventilated stables are injuriously affected, it is so because of other conditions and causes than those usually accepted.

"The amount of CO_2 present in any ordinary stable or any probable lack of oxygen is not seriously important.

"The amount of CO_2 present in the atmosphere is a very unreliable guide as to hygienic conditions.

"The mysterious and oft quoted 'organic matter,' if harmful, may be so because it furnishes favorable conditions for disease producing bacteria.

"A well-lighted stable with poor ventilation is superior from a sanitary standpoint to a well ventilated but poorly lighted one, since the injury, if any there be, apparently comes from disease producing bacteria and various other causes rather than from harmful gases.

"The ventilation plans for a stable need not be made with any special consideration for CO_2."

The rational feeding of farm animals, A. CARRÉ (*Jour. Soc. Cent. Agr. Haute-Garonne, 16 (1906), No. 172, pp. 287–345*).—Various questions connected with feeding farm animals are discussed, methods of calculating rations are explained, and other data of a similar nature are summarized.

Feeding whole grain, R. S. SHAW and H. W. NORTON, Jr. (*Michigan Sta. Bul. 242, pp. 59–67*).—The purpose of the experiments reported was to determine the percentage of whole grain passing through the digestive tract and to ascertain if any changes take place in the composition of the grain. No effort was made to compare the feeding value of whole grain and ground grain.

The tests were made with 6 cows, 6 yearling heifers, and 6 6-months-old calves, and lasted 3 weeks. Corn, oats, and a mixture of corn and oats were fed to each animal at different times.

The results are summarized as follows:

Proportion of grains eaten recovered whole in the feces—Experiments with cattle.

	Whole corn recovered.	Whole oats recovered.	Whole corn and oats recovered.
	Per cent.	*Per cent.*	*Per cent.*
Cows	22.75	12.06	26.46
Heifers	10.77	5.48	17.50
Calves	6.28	2.98	5.78

"Chemical analyses showed practically the same composition of grain as before feeding, therefore it is safe to conclude that the animal derives no benefit from grain which passes through the digestive tract unmasticated.

"The germinating power of the grain passing through the system was affected very markedly, but not entirely destroyed, as 4.3 per cent of the corn and 10.6 per cent of the oats germinated after this treatment."

Cattle feeding experiments, J. A. CRAIG and F. R. MARSHALL (*Texas Sta. Bul. 86, pp. 23, figs. 10*).—In the first of the experiments reported on the value of molasses for fattening cattle a lot of 6 steers fed on an average a daily ration of 14 lbs. of cotton-seed meal and corn chop 1 : 2 and 12.5 lbs. of cotton-seed hulls

with a full feed of molasses (3.1 qt. per head) made an average daily gain in a 70-day period of 1.71 lbs. at a cost of 10.05 cts. per pound. Similar animals fed the same grain ration but no molasses made an average daily gain of 1.27 lbs. per head at a cost of 11.3 cts. per pound.

In the second test cotton-seed hulls, cotton-seed meal, and corn chop, supplemented by large and small amounts of molasses, were compared with cotton-seed hulls, cotton-seed meal, and corn chop alone, corn chop being added to the rations in the second and third periods. In the last 44 days of the test, which as a whole covered 100 days, alfalfa hay was fed to all the lots in addition to the other feeds and a little molasses was given to the lot which had previously received none. The gains ranged from 1.92 lbs. per head per day in the case of the lot which had received no molasses throughout the greater part of the test to 2.71 lbs. with the lot receiving the full molasses ration. The gain was most cheaply made with the latter lot, costing 4.95 cts. per pound, and was most expensive with the former lot, costing 5.55 cts. per pound.

In a third test feeding molasses from a trough to cattle on grass was studied with 2 lots of 10 steers each. They were given similar rations of cotton-seed hulls, cotton-seed meal, and alfalfa hay. The lot fed molasses ad libitum from a trough was given less corn chop than the other lot. When fully accustomed to the molasses 12 lbs. per head per day were eaten on an average. "Some steers seemed especially fond of the molasses and ate it in such large quantities as to cause them to scour." On the molasses ration the average daily gain in the 60 days of the test was 1.14 lbs. and the cost of a pound of gain 13 cts., as compared with 0.97 lb. at a cost of 12.7 cts. with the lot fed practically no molasses for comparison. "This is the only experience we have had with the system of feeding clear molasses separately."

A test with 3 lots of 10 pigs each is briefly reported in which corn chops alone and with cotton-seed meal and cotton-seed meal and molasses were compared. On the corn chops alone the average daily gain was 0.51 lb. per pig and the cost of a pound of gain 8.14 cts. On corn chops and cotton-seed meal 2:1 the average daily gain during the same period was 0.66 lb. and the cost of a pound of gain 7 cts. On a similar grain ration with molasses added the average daily gain in 43 days was 0.82 lb. per head and the cost of a pound of gain 6.32 cts.

Data on the use of molasses as a horse feed are also summarized.

The conclusions which were drawn regarding the feeding of molasses were in effect as follows: In the tests reported the addition of molasses to a fattening ration for cattle always produced an increased gain and adding molasses to a ration of cotton-seed meal and hulls diminished the cost of gain. When molasses was added to a balanced ration, though the cost was not decreased, larger gains were noted and the appearance of the cattle was improved. No undesirable results were noted when yearling steers were fed a gallon of molasses per head per day, and there is good reason to believe that larger amounts might be used. Molasses returned from 3 to 30 cts. per gallon, the lower value being obtained when it was added to a well-balanced ration and the higher value when it was added to a ration which in the early part of the feeding period was not well balanced.

Rough rice for steer feeding was also studied with 3 lots of 5 animals each, the basal ration consisting of cotton-seed hulls, cotton-seed meal, and alfalfa hay. On the basal ration alone the average daily gain per head, in the 70 days covered by the test, was 1.36 lbs. and the cost of a pound of gain 5.9 cts. When the larger quantities of whole and ground rice were fed the average daily gain was 1.4 lbs. per head and the cost 9.01 cts., and with the smaller ration of whole and ground rice the values were 1.52 lbs. and 7.15 cts.

"With cotton-seed hulls for roughage it required 2.3 lbs. of rough rice to equal 1 lb. of cotton-seed meal in this test. If the rice were charged at $10 per ton, the gains would cost the same as in the lot eating cotton-seed meal and hulls.

"This is by no means conclusive evidence as to the feeding value of rough rice. Fed with alfalfa, cowpea, or peanut hay, it should be worth more than when fed with cotton-seed hulls. Compared to cotton-seed meal when feeding with hulls it lacks both in composition and the physical qualities which cause meal to be so heartily relished."

Fattening steers on barley and rejected wheat, J. H. Shepperd and W. B. Richards (*North Dakota Sta. Bul. 73, pp. 239-258, figs. 2*).—In continuation of earlier work (E. S. R., 10, p. 671), 7 steers were fed ground barley and bran 2:1 with corn fodder and hay (millet, slender wheat grass, and oat hay). In 132 days, the average daily gain was 2.14 lbs., 6.57 lbs. of grain being required per pound of gain. The maximum amount of grain eaten per steer was 20.3 lbs. The average dressed weight was 62.4 per cent of the live weight and the calculated profit was $7.57 per head.

In the second test, made with 2 lots of 11 steers each a ration of rejected wheat and bran 3:1 was compared with corn meal and bran 3:1, the grain ration being supplemented by hay of inferior grade similar to that mentioned above.

On the wheat ration the average daily gain in the 112 days of the test was 0.7 lb. per head, 17 lbs. of grain being required per pound of gain. On the corn-meal ration similar values were 1.47 lbs. and 8.5 lbs. The cost of a pound of gain in the 2 cases was 12.9 and 8.5 cts., respectively.

"It required 52 per cent more wheat than corn to produce a pound of gain. The difference in the cost per pound of gain was very different because of the difference in the price of the corn and the rejected wheat."

At the close of the test all the steers were fed corn and bran until they were ready for market (7 weeks), the average daily gain of the animals previously fed wheat being 3.08 lbs. per head and of those fed corn 1.5 lbs.

Considering the whole experimental period, the average gains of the 2 lots were 1.42 and 1.47 lbs., respectively, and the cost of a pound of gain 7.5 and 9.3 cts. According to the authors, "rejected wheat and bran will prove unsatisfactory as a ration to finish steers upon."

"The results derived from the 2 feeding periods seem to indicate that rejected wheat and bran would prove as good a grain ration to feed during the first part of the feeding period as corn and bran, and that good gains can be made by feeding corn toward the end of the feeding period. It is difficult to assign a cause for this change of feeds producing such large gains. The extra growth made by the steers in . . . [the lot fed the wheat] may account for the gains made later on. The condition of their systems must have been better for assimilating the new ration."

Both lots were fed at a loss, the amount being $1.52 per head with the wheat-fed steers and $5.81 with the corn-fed lot. An analysis of the rejected wheat used is reported.

A plan for the improvement of Michigan cattle, R. S. Shaw (*Michigan Sta. Bul. 241, pp. 35-53, figs. 5*).—It is stated that the present bulletin is intended as a preliminary to reports of investigations on animal breeding now in progress or contemplated at the station. Existing conditions in cattle breeding, the inferiority of the common stock and related questions are discussed and general directions given for the upbreeding of cattle.

The improvement of Michigan cattle, in the author's opinion, necessitates

a knowledge of existing conditions and facts regarding breeding, and would be greatly facilitated by the proper formation of breeders' associations.

Cull beans as a food for swine, R. S. Shaw and A. C. Anderson (*Michigan Sta. Bul. 243, pp. 71-81*).—The use of cooked cull beans as a feed for young and growing pigs and for fattening purposes was studied.

When 4 lots of 4 or 5 pigs each, weighing on an average not far from 50 lbs., were fed beans with corn meal 3:4 for 10 weeks the average gain ranged from 0.797 lb. to 1.04 lbs. per head per day, and the cost of a pound of gain from 2.63 cts. to 2.95 cts.

In this and subsequent tests the beans were cooked either in a cauldron by boiling or in a barrel into which live steam was passed. The beans were fed warm, other feed when used being mixed with them after cooking. Sufficient salt was added to make the ration palatable.

As the above-mentioned ration was, in the author's opinion, not well suited to the pigs some middlings were substituted for part of the beans in a test made with 2 lots of 5 pigs, each weighing on an average 73 lbs., the mixture selected being beans, corn meal, and middlings 2:3:2. The average daily gain in the 10 weeks of the trial was 1.34 lbs. per head, and the cost of a pound of gain 3.1 cts.

The average daily gain on sour skim milk and corn meal 5:1, in a control test made with 2 similar lots, was 1.34 lbs., and the cost of a pound of gain 3.7 cts.

Five lots of 4 and 1 lot of 6 animals, weighing about 150 lbs. each at the beginning of the trial were used to test the value of cull beans for fattening pigs, and the results reported are for a period of 8 weeks. Three of the lots were given cooked beans only, and the average gain was 1.1 lbs. per head per day, 4.21 lbs. of beans being consumed per pound of gain, of which the cost was 2.53 cts. In the case of the 3 similar lots on beans and corn meal 1:1 the average daily gain was 1.52 lbs., the cost of feed per pound of gain being 3.25 cts., 2.03 lbs. of beans and an equal quantity of corn meal being required per pound of gain.

"It would appear that hogs of the weights and ages of those fed in this experiment could reasonably be expected to make a gain of about a pound per day on a ration consisting of beans only, and that the same sort of hog could reasonably be expected to make a gain of about 1.5 lbs. per day if an equal amount of corn were supplied with the bean ration. Further, it would appear that the gains made by the bean-fed hogs would cost about $2.50 per 100 lbs. and those made by the beans and corn fed hogs would cost about $3.50 per hundredweight," rating corn meal and beans at what were considered fair prices.

When judged by experts as to quality, the pigs fed a ration containing corn meal were rated at a higher value per pound than those fed the beans only.

According to the authors, "beans can be fed to swine only in the cooked form. The pig seems to be unable to utilize beans which are at all hard or firm, even though they have been boiled for some time, hence it is very essential that they should be thoroughly cooked. To supply a single feed of half-cooked beans to a pen of hogs robs them of their appetites and relish for their food, if indeed it does not put them off feed." Sufficient water should be used in cooking to supply the amounts needed by the pigs, but the feed should not be excessively sloppy.

"All refuse grains contain more or less foreign material. Cull beans are no exception to the general rule, perhaps the most objectionable ingredient being the gravel stones. . . . By the use of a hand fanning mill adapted for bean cleaning, a considerable portion of the stones may be eliminated."

"In winter feeding it will be advisable to supply the feed while warm," but

not hot. "Pails should be rinsed after each feeding, and especial care should be taken to clean the kettle or barrel after each cooking and not allow sour or moldy material to collect about the food receptacle."

"Mixed with other grains, cull beans may be fed to sheep, and large quantities are used in this State for this purpose each year; it is reported that they are used as a food for dairy cows; they are also fed to swine.

"While this work was undertaken in an effort to furnish information to a large number of inquiring residents of this State, it is not desired to advocate the extensive use of beans as a swine food, especially in the fattening or finishing period. Pork from hogs which have been fattened quite largely on beans is generally soft and lacking in quality. If a considerable portion of the pork produced in the State were of this kind it would lower prices and work serious harm to the swine industry.

"It is generally conceded that bean-fed hogs store up a fat having a lower melting point, and consequently a softer fat, than hogs fed upon many other feeds; and that a considerable portion of the element called quality in pork is dependent upon the melting point or character of the fat stored up. In the case of mutton finished upon beans no such criticism has been made, probably because there is relatively less fat in the carcass of the sheep, and its character is not so essential to the quality of the meat as in the case of the pig."

Fat pigs, RASQUIN (*Jour. Soc. Agr. Brabant et Hainaut, 52 (1907), No. 5, pp. 115–117*).—In a discussion of marketing pork, brief reference is made to records of data regarding losses in weight and similar topics. In general, the author states that the dressed carcass constitutes, on an average, 80 per cent of the live weight and the internal organs 15 per cent.

The normal temperature of the goat, G. C. C. DAMANT (*Jour. Physiol., 35 (1906), No. 1–2, Proc. Physiol. Soc., 1906, p. V*).—As shown by the average of 194 measurements of rectal temperature made with 17 goats, the mean body temperature in the morning was 39.75° C. and in the evening 40° C.

First lessons in poultry keeping, J. H. ROBINSON (*Boston: Farm-Poultry Pub. Co., 1906, pp. 160, figs. 29, charts 2, dgms. 5*).—A second-year course for the home study of poultry keeping. Some of the subjects included are duck, goose, and turkey raising, kinds, breeds, and varieties of fowls, eggs and egg production, winter egg production, and poultrymen's organizations.

Report of poultry division, D. D. HYDE (*New Zeal. Dept. Agr. Ann. Rpt., 14 (1906), pp. 121–140, figs. 6*).—Brief statements are made regarding the year's work of the poultry department, results of egg-laying competitions, grading and exporting of poultry and eggs, the construction of trap nests, egg carriers, and related matters. Data are also given regarding the departmental poultry stations. In general, "the returns for the year from the 4 poultry-breeding stations show an increase in the number of birds and a decrease in the number of eggs sold for breeding purposes."

Which weighs the most, the egg or the chicken which comes from the egg, C. A. WHITING (*Bul. South. Cal. Acad. Sci., 5 (1906), No. 3, pp. 59, 60*).—A fertile egg during the process of incubation lost a little over 20 per cent in weight, while a sterile egg receiving the same treatment lost 15.5 per cent. Another fertile egg weighing 62.842 gm. lost during incubation 21.64 per cent in weight. The chick hatched from the egg weighed 44.204 gm., or 29.65 per cent less than the egg before incubation. A fertile egg violently skaken before incubation to destroy the germ lost 17 per cent during incubation.

Frog farming, W. E. MEEHAN (*Penn. Dept. Fisheries Bul. 4, pp. 13*).—For some years the Pennsylvania department of fisheries has been studying various questions pertaining to frog raising and the present bulletin summarizes data on the subject and may be regarded as a progress report.

According to the author, "frog ponds may be in any waste, marshy land, providing water can be flowed through them, or any land whatever into which water can be introduced from a stream or spring, preferably the former, because of a usually higher temperature." For profitable frog culture the author believes at least 3 acres are required, and this should be divided into about 10 ponds. As the ponds are not all needed at the beginning, their construction may be scattered over a period of 2 years. At the outset a small pond is required for hatching eggs and developing the tadpoles, then ponds are needed for the young frogs and for the 2-year olds and 3-year olds. The ponds must be fenced to prevent the frogs from escaping.

The principal enemies are birds, snakes, eels, fishes, and the larvæ of the water beetle, the latter being especially dangerous.

As regards food, tadpoles will eagerly devour any dead animal matter, but prefer fish. About 25 lbs. of fish per week is sufficient for the needs of 60,000 tadpoles. Fifteen to 20 lbs. of liver would also be sufficient for the same number, but the liver must be fresh. The liver should be fed in small quantities, but the fish may be thrown into the water whole. After the legs develop the quantity of food should be diminished. Fully developed frogs need live feed and insects may be attracted to the ponds by placing boards near the edge smeared with masses of honey, and in similar ways.

Other questions regarding the habits of frogs, feeding, rearing, etc., are also discussed.

DAIRY FARMING—DAIRYING—AGROTECHNY.

Report on further experiments on the feeding of dairy cows at Offerton Hall, C. B. Jones (*Durham County Council, Ed. Com., Offerton Bul. 2, pp. 36*).—This is a continuation of experiments previously noted (E. S. R., 17, p. 901).

The feeding of concentrated food on pasture (pp. 5–23).—Ten cows were divided into 2 equal lots, one of which was pastured for 12 weeks without concentrated feed, while the other lot also pastured was fed 4 lbs. of concentrated feed daily during the first half of the experiment and 8 lbs. during the second half. The experiment was repeated 1 year later. The results obtained during the 2 years indicate, according to the author, that with average pasture the advantage of feeding a supplementary grain ration of 4 to 8 lbs. as regards the yield of milk is exceedingly small. The cost of the concentrated feed was out of all proportion to the value of the increase in the yield of milk. The quality of the milk was not appreciably affected. It is, therefore, considered unprofitable to feed cows more than enough food to keep them in a thriving condition.

The effect of brewers' grains on milk (pp. 23–36).—Two experiments are reported, in each of which 2 lots of 5 cows were fed in turn for 8 weeks a daily ration containing 20 lbs. of brewers' grains. The yield of milk was materially increased by the brewers' grains, but the percentage of fat was thought to be slightly reduced during the early part of the lactation period. There was no appreciable effect on the solids-not-fat in the milk nor on the live weight of the cows.

Grape pomace in the feeding of dairy cows, A. Marescalchi (*Coltivatore, 53 (1907), No. 11, pp. 334–337*).—The author discusses the composition and feeding value of grape pomace, concluding that this material may be fed to the extent of 10 kg. per head daily without injury to the health of the animals or unfavorable effects on the milk production.

Remarkable difference in dairy cows, W. J. Fraser (*Illinois Sta. Circ.*

106, pp. 16, figs. 10).—The records of 2 cows at the station are used as the basis for a popular discussion of the importance of testing dairy cows.

The three-year-old milk and butter record, A. L. HAECKER (*Breeder's Gaz., 51* (*1907*), *No. 6, p. 281, fig. 1*).—This gives 1 year's record of a Holstein cow, beginning when she was 3 years and 1 month old. The yield of milk was 18,573.4 lbs. and of butter fat 620.44. The net profit was estimated at $156.20.

A contribution to the anatomy and physiology of the mammary gland, F. BERTKAU (*Anat. Anz., 30* (*1907*), *No. 7–8, pp. 161–180, figs. 7*).—The author concludes, as a result of his investigations, that with suitable histological methods the epithelium of the empty or partly filled alveoli appears as simple columnar epithelium, as in other glands. The many variations which have been described are believed to be due to post-mortem changes or to unsuitable fixing and embedding methods. The formation of milk is, therefore, considered a true secretory process and in no manner associated with a total or even partial necrosis of the secreting epithelium. The tall cylindrical epithelial cells of the empty alveoli gradually become cuboidal and finally squamous as the alveoli become filled. A bibliography is appended.

The results of a chemical, microscopical, and bacteriological examination of samples of London milks, R. T. HEWLETT and G. S. BARTON (*Jour. Hyg.* [*Cambridge*], *7* (*1907*), *No. 1, pp. 22–31*).—Examinations were made of samples of the milk sent to London from 26 counties. The conclusions drawn from the results obtained are as follows:

"There is no correlation between poor milk and its content of total bacteria, *Bacillus coli* or *B. enteritidis sporogenes*. There is no correlation between the content of *B. coli* and of *B. enteritidis sporogenes*. The total number of organisms was below 2,000,000 per cc. in 22 out of the 26 samples (85 per cent) and below 1,000,000 in 16 of the samples (61.5 per cent). *B. coli* was found in 46 per cent of the samples, in a quantity of milk not exceeding 1 cc. *B. enteritidis sporogenes* was found in 60 per cent in a quantity of milk not exceeding 20 cc. Preservatives in the form of formalin, or boric acid, or borates, were not detected in any sample. The acidity on the whole is well below Newman's standard [22 cc. tenth normal sodium hydroxid per 50 cc. of milk]. *B. tuberculosis* was not so frequent as might have been expected from the results of other investigators."

The ferments of milk, C. BRAHM (*Zentbl. Gesam. Physiol. u. Path. Stoffwechsels, n. ser., 2* (*1907*), *Nos. 3, pp. 81–86; 4, pp. 129–132*).—This article summarizes information concerning the different enzyms which have been reported as occurring in milk.

Influence of the Bulgarian ferment on milk, G. BERTRAND and G. WEISWEILLER (*Liebig's Ann. Chem., 351* (*1907*), *pp. 486–503*).—The authors investigated the ferment used in the preparation of the Bulgarian milk product known as Youghort. This organism is considered the most active of those which convert milk sugar into lactic acid.

According to the conclusions reached, this ferment renders about 0.1 of the casein soluble, but uses only a very small part of this for its own growth. It causes a very slight saponification of the fat. The action of the ferment upon milk sugar is, however, very vigorous, and with the aid of a lactase converts practically all of the milk sugar into a mixture of levulo and dextro-rotary lactic acids, of which the latter predominates. The quantity of lactic acid may reach 25 gm. per liter. There is also about 0.5 gm. per liter of succinic acid and about the same quantity of acetic acid. A very small quantity of formic acid is also probably present. This ferment is considered the first typical lactic-acid ferment known to produce succinic acid and also the first to hydrolyze considerable quantities of milk sugar before converting it into lactic acid.

Origin of oxydases and reductases in cow's milk, O. JENSEN (*Rev. Gén. Lait., 6 (1906), Nos. 2, pp. 34–40; 3, pp. 56–62; 4, pp. 85–90*).—The conclusions drawn by the author from his studies are as follows:

The peroxydase in cow's milk is derived solely from the animal and probably in great part from the food.

The catalase is derived to a small extent from the leucocytes (the catalase of fresh milk) and to a large extent from bacteria.

The hydrogenase and the reductase are wholly of bacterial origin.

The aldehyde catalase (the reductase of fresh milk) is derived entirely from the milk globules.

The oxidation index of milk, E. COMANDUCCI (*Gaz. Chim. Ital., 36 (1906), II, No. 5–6, pp. 813–815*).—The number of cubic centimeters of tenth-normal potassium permanganate required in the presence of sulphuric acid to oxidize 1 cc. of milk was found to vary with the different kinds of milk. Cow's milk gave figures varying from 50 to 52, goat's milk from 44 to 46, and sheep's milk from 43 to 48.

Investigations on Storch's reaction, M. SIEGFELD and G. SAMSON (*Molk. Ztg., 21 (1907), No. 5, pp. 103, 104, dgm. 1*).—Milk which had been heated at 80 to 100° C. showed no coloration upon the addition of 2 drops of hydrogen peroxid and 2 drops of a 2 per cent solution of paraphenylendiamin. When, however, 2 drops of formalin (1 : 1) had been added to 100 cc. of the milk before heating, the reaction was similar to that for raw milk. This difference was marked for 10 days. Objections which have recently been raised to the value of Storch's reaction are consequently considered groundless. The reaction was less marked when larger quantities of formalin had been added to the milk, and the strongest reaction was obtained when 5 drops of a 1 : 10 per cent solution had been used. It was immaterial whether this addition was made before or after heating. Other experiments with different amounts of formalin and varying quantities of the reagents are also reported.

Sterilization of milk with hydrogen peroxid, E. ROUSSEAU (*Indus. Lait. [Paris], 32 (1907), Nos. 3, pp. 41–43; 6, pp. 89–91*).—A review of the literature leads the author to conclude that Budde's method of sterilizing milk with hydrogen peroxid does not in general give the positive and certain results secured by pasteurization.

Note on the occurrence of diphtheria bacilli in milk, W. E. MARSHALL (*Jour. Hyg. [Cambridge], 7 (1907), No. 1, pp. 32–34*).—The author notes the isolation from milk of the diphtheria bacillus in a virulent form.

Preliminary report on the water content, melting point, and keeping quality of butter, J. MICHELS and F. S. SHIVER (*South Carolina Sta. Bul. 125, pp. 14*).—The authors undertook to investigate the influence of the water content of butter upon its keeping quality, but were unable to secure samples with markedly different amounts of moisture by the method given in Bulletin 76 of the Iowa Station (E. S. R., 15, p. 1114). The work as carried out was therefore restricted to a study of some of the factors which have been considered as affecting the water content of butter, some attention, however, being given to the melting point and keeping quality. The results obtained are summarized as follows:

"Butter churned moderately soft and then overchurned in the wash water to particles the size of hens' eggs averaged only a trifle higher in water content than normally churned butter.

"The melting point of butter fat appears to have no influence on the water content of butter.

"The water content of butter made from very rich cream and medium rich cream is the same.

"Brine salting increases the water content of butter about 1 per cent over dry salting.

"The average of fifteen trials shows that butter worked two minutes contains 0.64 per cent more water than butter worked four minutes.

"Normal cream overchurned in half churnful of wash water to particles the size of hens' eggs increased the water content of the butter only slightly.

"The melting point of butter fat from three different feeds varied as follows: (1) When 10 lbs. of wheat bran were fed with 45 lbs. of corn silage, the melting point was 92.9° F. (2) When 6 lbs. of cotton-seed meal were fed with 45 lbs. of corn silage, the melting point was 98.6° F. (3) When 6 lbs. of linseed meal were fed with 45 lbs. of corn silage, the melting point was 91.5° F.

"Butter worked two minutes possesses poorer keeping quality than similar butter worked four minutes.

"Butter worked only two minutes presents a leaky appearance.

"Butter churned soft and then overchurned in wash water to particles the size of hens' eggs possesses a comparatively weak body.

"Churning butter soft is conducive to a heavy loss of fat in the buttermilk.

"Butter from 5 lbs. of cotton-seed meal fed in conjunction with corn silage possesses an excellent grain and body."

Water in butter, J. Wauters (*Bul. Soc. Chim. Belg., 20 (1906), No. 11–12, pp. 365–373*).—The author considers an excess of water an adulteration, the same as the addition of foreign fats, and points out that the regulations in force in Belgium are insufficient to prevent this fraud. In determining the water content of butter kept for some time, the sample, according to the author, should be obtained from the central portion, as the exterior has lost much by evaporation.

The presence of an abnormal amount of water in butter, A. Trillat (*Indus. Lait. [Paris], 32 (1907), No. 10, pp. 205, 206*).—The author comments upon the frequent occurrence of an abnormal amount of water in butter and discusses briefly methods of determination and prevention.

On the origin of aldehydes in cheese, Trillat and Sauton (*Compt. Rend. Acad. Sci. [Paris], 144 (1907), No. 9, pp. 495–498*).—The presence of acetic aldehyde in cheese is attributed to the fermentation of lactose by yeasts. The amount of aldehyde produced is considered dependent upon a number of conditions, including the kind of yeast, exposure to light, alkalinity of the medium, the amount of lactose present, and the aeration of the cheese. Conditions favoring the formation of aldehydes and hence a bitter taste in the cheese are considered to be the preparation of the curd at too low a temperature and draining for too long a period.

Influence of temperature on the manufacture, ripening, and preservation of soft cheese, Mazé (*Indus. Lait. [Paris], 32 (1907), No. 9, pp. 161–169*).—The importance of controlling temperature in the different stages of cheese making is discussed. The advantages of introducing mechanical refrigeration are emphasized.

The salting of soft cheese, M. Mesnil (*Indus. Lait. [Paris], 32 (1907), No. 9, pp. 187–189*).—The author discusses the rôle played by salt in the manufacture of soft cheese and the manner in which the salting should be done.

The literature of milk and dairying, 1906, R. W. Raudnitz (*Separate from Monatsschr. Kinderheilk., 5 (1906), No. 6, pp. 55*).—This is a review of the literature of milk during 1906.

On some chemical properties of casein and their possible relation to the chemical behavior or other protein bodies, with special reference to hydrolysis of casein by trypsin, T. B. Robertson (*Jour. Biol. Chem., 2 (1907),*

No. 4, pp. 317–383).—In the extended investigations here reported casein was used as a means of studying the relation between the ion proteids and the molecular compounds of protein bodies with electrolytes and also the influence of electrolytes upon tryptic digestion. A method for the quantitative estimation of casein is included in the article.

The industrial utilization of casein, D. SIDERSKY (*Indus. Lait.* [*Paris*], *32* (*1907*), *No. 11, pp. 231–238*).—This is a general report on this subject, including the preparation of casein and the various uses made of it.

Wine and its chemistry, P. ARAUNER (*Der Wein und seine Chemie. Kitzingen: A. Wirth, 1906, pp. IX+189, figs. 38*).—This is a practical handbook on the manufacture, examination, and valuation of wines.

Sulphuring and refrigeration in wine making, F. COUSTON and E. DELORME (*Prog. Agr. et Vit.* (*Ed. l'Est*), *28* (*1907*), *Nos. 8, pp. 237–245; 9, pp. 267–273*).—Wine-making experiments in Tunis are reported. The best results were obtained by the use of about 40 gm. of sulphurous acid per hectoliter of must. This retarded fermentation for 3 to 5 days, or until the free sulphurous acid was reduced to less than 5 gm. per hectoliter. Equally good results were obtained with sulphur fumes, potassium metabisulphite, and sodium bisulphite. The cost is considered the most important consideration as to which form of sulphur to use. The relative cost of 40 gm. of sulphurous acid when sulphur, sodium bisulphite, and potassium metabisulphite were used was proportionately 1 : 13 : 24.

The new methods of making dry wines, C. MAYER (*Agr. Jour. Cape Good Hope, 30* (*1907*), *No. 1, pp. 70–75*).—The methods employed by the author are outlined and fermentation records are reported.

Austrian wines, B. HAAS (*Ztschr. Landw. Versuchw. Österr., 10* (*1907*), *No. 1, pp. 1–26*).—Analyses of 177 samples of wine from various parts of Austria are reported.

Progress in the manufacture of beet sugar in 1906, E. O. VON LIPPMANN (*Chem. Ztg., 31* (*1907*), *No. 11, pp. 123–125*).—This is a general review of the literature of the beet-sugar industry during 1906 from the standpoint of agriculture, technology, and analytical chemistry.

VETERINARY MEDICINE.

Diseases common to man and animals, E. MOSNY ET AL. (*Maladies Communes a l'Homme et aux Animaux. Paris: J. B. Baillière & Sons, 1906, vol. 4, pp. 428, figs. 26*).—In this volume attention is given to a discussion of tuberculosis, scrofula, glanders, actinomycosis, anthrax, psittacosis, rabies, tetanus, pork measles, trichinosis, and ankylostomiasis. In the account of each disease a discussion is given of the etiology, symptoms, development, conditions of intertransmission, and treatment.

Album guide to sanitary inspection of meats, E. AUREGGIO (*Album Guide de l'Inspection Sanitaire des Viandes. Lyon: Soc. Lyonnaise Photochromogravure, 1906, pp. 6, pls. 90*).—The purpose of this volume is to present illustrations of normal and pathological conditions which are of interest in the inspection of the meat of all kinds of animals used for food. The illustrations are for the most part colored and the text is confined to legends describing the various figures.

Annual report on progress in the study of pathogenic micro-organisms, P. VON BAUMGARTEN and F. TANGL (*Jahresber. Path. Mikroorgan., 20* (*1904*), *pp. XII+1106*).—The present article contains a classified review of literature on the subject of pathogenic micro-organisms published in 1904. This review

has been made along lines very similar to those followed in previous reports, but particular attention has been given to pathogenic protozoa. A general author and subject index is appended to the volume in addition to departmental indexes throughout the text.

The process of suppuration in domestic animals, M. KREUTZER (*Wchnschr. Tierheilk. u. Viehzucht, 50 (1906), No. 47, pp. 921–928*).—As a result of a study of various cases suppuration in different domestic animals the author comes to the conclusion that in the horse the majority of cases of suppuration is due to *Staphylococcus pyogenes aureus et albus*, while in cattle and sheep *S. pyogenes* is most active, and in hog and dog, *S. pyogenes aureus*.

Report of the State veterinarian, L. PEARSON (*Ann. Rpt. Penn. Dept. Agr., 11 (1905), pp. 103–128*).—During the year under report considerable attention was given to outbreaks of rabies and glanders and to the repression of anthrax and tuberculosis. The campaign of the State veterinarian against tuberculosis has been well organized upon a satisfactory basis and is yielding visible results. The author is confident that with the continuation of his plan upon a conservative basis tuberculosis will become so reduced in extent as to be of little economic importance in public health. Copies are given of various State laws relating to animal diseases, and brief notes are presented on the prevalence of actinomycosis, contagious abortion, and other diseases.

Report of the chief inspector of stock, R. E. WEIR (*Jour. Dept. Agr. West Aust., 14 (1906), No. 5, pp. 342–346*).—Pleuro-pneumonia occurred in only one outbreak during the year and that was promptly eradicated. Tuberculosis is reported as unusually common among pigs. Brief notes are also given on ticks and the general state of health of cattle in the colony.

Relationship between bovine and human tuberculosis, ZWICK (*Ztschr. Fleisch u. Milchhyg., 17 (1906), No. 3, pp. 69–81*).—In this article the author reports the results of his investigation of certain cases of artificial transmission of pure cultures of human and bovine tubercle bacilli upon cattle, the distinction between bovine and human types of tubercle bacilli, and of a supposed case of the transmission of tuberculosis to two children in one family through the agency of milk.

The author found that the bovine tubercle bacilli were far more virulent for cattle than human bacilli, and that injection into the udder through the milk ducts is a very satisfactory method of testing the virulence of tubercle bacilli. The opinion is given that the establishment of two distinct types of tubercle bacilli is fully justified. The evidence for the transmission of tuberculosis to children through milk was not conclusive in the particular cases examined, but the author believes that such transmission may occur, and recommends that the authorities concerned should in all cases require a strict sanitary control, particularly of milk supposed to be of high quality and used in feeding children.

The demonstration of tubercle bacilli in market milk, G. KUHN (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 2 (1906), No. 1, pp. 58–61*).—According to the experiments of the author the addition to milk of 0.5 per cent boric acid either as a powder or in solution is sufficient to prevent the coagulation of the milk for a period of 15 days. This addition of boric acid does not exercise any apparent effect upon tubercle bacilli which may be present in milk.

Work of the commission on tuberculosis in animals, H. MITCHELL (*Ann. Rpt. N. J. Bd. Agr., 33 (1905), pp. 209–216*).—During the inspection of cattle 487 were found to be tuberculous and were slaughtered, the owners being paid an average indemnity of $21.59 per head. The more progressive dairymen are all desirous of having herds tested in order to get rid of tuberculosis.

The infectiousness of different cultures of tubercle bacilli, K. VAGEDES and C. FRAENKEL (*Ztschr. Hyg. u. Infektionskrank., 55 (1906), No. 2, pp. 321–330*).—The authors present opposing sides of the controversy regarding certain methods of determining the virulence of tubercle bacilli of different origin. One of the chief points of controversy involves the question whether rabbits or guinea pigs are the more suitable experimental animals for determining the degree of virulence of tubercle bacilli.

The virulence of different cultures of tubercle bacillus, C. FRAENKEL and E. BAUMANN (*Ztschr. Hyg. u. Infektionskrank., 54 (1906), No. 2, pp. 247–261*).—During the investigations reported in this paper, 37 cultures of tubercle bacilli were tested from different cases of human tuberculosis. The experimental animals included rabbits, rats, mice, and guinea pigs, but the authors state that the guinea pig is the only one of these animals which is well adapted for demonstrating slight differences in the virulence of different cultures of tubercle bacilli. As a matter of fact, little difference was observed in the virulence of the various cultures which were used. In some cases cultures which had been maintained for a long time on artificial nutrient media showed no diminution of their virulence.

Immunization with anthrax and tubercle bacilli attenuated by sunlight, A. DI DONNA (*Centbl. Bakt. [etc.], 1. Abt., Orig., 42 (1906), Nos. 7, pp. 642–646; 8, pp. 771–775*).—In the investigations reported in this article it was found that sunlight has a pronounced effect in reducing the toxic effect of the tubercle bacillus. Naturally the effect of sunlight becomes more pronounced as the exposure of the tubercle bacilli to it is lengthened. Attention is called to the fact that abscesses, general intoxication, and death may follow upon inoculation with tubercle bacilli killed by heat or by any other means except sunlight. It appears from the author's experiments, however, that sunlight has the effect of attenuating or entirely destroying the most active toxic bodies contained in the tubercle bacillus.

The cause of trembles in cattle, sheep, and horses and of milk sickness in people, E. L. MOSELEY (*Ohio Nat., 6 (1906), Nos. 4, pp. 463–470; 5, pp. 477–483*).—A historical statement is given of the prevalence of trembles and milk sickness, particularly in the Central States. Since 1840 suspicion has been fixed on white snake root (*Eupatorium ageratoides*) as the cause of the trouble, and certain experiments carried out previously to those of the author seemed to give color to this belief.

Portions of the plant and extracts from the same were fed to cats, dogs, rabbits, sheep, and other animals and produced poisonous effects. The symptoms produced in the experimental animals included general nervousness, weakness, and trembling, and the results were often fatal when large quantities were fed. During the experiments a boy accidentally received some of the plant and was affected with similar symptoms. The meat of a sheep poisoned with the plant produced toxic effects in the cats which ate it.

Post-mortem examinations failed to disclose many characteristic lesions or pathological conditions. The kidneys were somewhat enlarged, but other organs appeared to be in a normal state. The plant seems to produce its toxic effects rapidly, but is not irritant.

African coast fever, H. CREUTZ (*Berlin. Tierärztl. Wchnschr., 1906, No. 47, pp. 843, 844*).—It has been established by experiment that African coast fever may be transmitted by means of *Rhipicephalus appendiculatus*, *R. simus*, R. *niteus*, *R. evertsi*, and *R. capensis*. Partly on this account G. Neumann has proposed that the five named species should be grouped together in a subgenus as distinct from other species commonly referred to this genus. The symp-

toms of African coast fever are described. The author recommends as a preventive for the disease that cattle be dipped in an arsenical solution.

The piroplasma observed in cattle in Japan, M. MIYAJIMA and G. SHIBAYAMA (*Ztschr. Hyg. u. Infektionskrank., 54 (1906), No. 2, pp. 189–200, pl. 1*).—The authors studied the morphology and biology of the piroplasma which occurs in the blood of cattle in Japan with particular reference to other pathogenic organisms of this class.

It appears that inoculation with the piroplasma will produce a mild disease resembling in some respects cases of Texas fever, but the form of the blood parasite usually observed in Texas fever is not present in the blood. The parasite in question is believed to be of a harmless nature under ordinary conditions.

Suggestions of the federal council with regard to an imperial law on foot-and-mouth diseases, KRUEGER (*Deut. Tierärztl. Wchnschr., 14 (1906), No. 49, pp. 617–626*).—The German law regarding the suppression of animal diseases passed in 1880 and amended in 1894 is to be replaced by a new law. A large mass of material has been collected by the federal council through official veterinarians and others which will doubtless serve as a basis for the new imperial law. An abstract is given of the material thus collected, together with a preliminary draft of the proposed law.

Foot-and-mouth disease, C. STABILINI (*Clin. Vet. [Milan], 29 (1906), No. 48, pp. 1153–1155*).—Attention is briefly called to the strict precautions which are necessary to prevent the spread of foot-and-mouth disease after an outbreak has occurred. Quite frequently the quarantine regulations are not maintained as strictly as they should be and in such cases disastrous results may follow.

A form of gangrene among cattle in Paraguay, ELMASSIAN and R. URIZAR (*Ann. Inst. Pasteur, 20 (1906), No. 11, pp. 969–975, fig. 1*).—A form of gangrene was observed as a quite common disease of cattle in Paraguay. The first and most striking symptom was the appearance of a gangrenous plaque 10 to 15 cm. in diameter on the perineum. Occasionally these patches occurred also on the ears, tail, and udder and caused the destruction and sloughing off of affected tissue. No success was had in attempts to transmit the disease in experimental animals either with the blood of affected animals or with diseased tissue.

Further notes on the treatment of milk fever by air infusions, RABUS (*Wchnschr. Tierheilk. u. Viehzucht, 50 (1906), No. 44, pp. 861–863*).—The author reports success from the air treatment in cases of milk fever even where great weakness has persisted for 2 to 5 days after the cerebral symptoms have disappeared.

The treatment of tympanites in cattle, J. VENNERHOLM (*Svensk Vet. Tidskr., 11 (1906), No. 11, pp. 476–478*).—The treatment of tympanites should vary according to the symptoms presented in each individual case and according to the severity of the trouble and its cause.

Salt sick (Bovine uncinariasis), C. F. DAWSON (*Florida Sta. Bul. 86, pp. 14*).—Bovine uncinariasis is a chronic disease characterized by low fever, loss of appetite, a progressive emaciation, and anemia. It occurs throughout Florida and is also reported from Texas and Cape Cod. There are a number of species of Uncinaria which attack various domestic animals and man. In cattle the disease is most prevalent in range animals, the embryo worms being swallowed in contaminated food or water.

The disease may be diagnosed by the existence of pronounced anemia and by the detection of parasitic worms in the feces. The lesions are chiefly anemia and dropsy.

Bovine uncinariasis may be best controlled by attention to the hygiene of the

food and water. Rotation of pasture is therefore advocated, together with the administration of tonics and vermifuges, such as sulphate of iron, calomel, creolin, lysol, gasoline, and thymol.

Treatment and prevention of stomach worms and diarrhea of calves and lambs, J. LIGNIÈRES (*Bol. Min. Agr.* [*Buenos Ayres*], *6* (*1906*), *No. 1-2-3, pp. 110-120, figs. 4*).—In many instances it is difficult to determine without some study whether a particular outbreak of diarrhea in calves and lambs is due to bacterial infection or to the presence of stomach worms. In order that stock growers may save time in applying an efficient remedy, the author recommends the use of a mixture containing 1 to 2 parts of creosote, 4 parts of carbolic acid, 8 parts of naphthalene, 4 parts of kamila, and 16 parts of male fern. This mixture is effective against either stomach worms or intestinal bacteria and has given good results when administered in water as a drench. For young calves and sheep the usual dose is 5 cc. in a small quantity of water.

Some problems in sheep diseases, F. S. H. BALDREY (*Jour. Trop. Vet. Sci.*, *1* (*1906*), *No. 4, pp. 387-409*).—As a rule little attention is given to sheep and goat diseases in India, but serious diseases are nevertheless present to considerable extent. A disease commonly known as gillar was studied by the author, with the result that a parasite belonging apparently to the genus Bilharzia was found and is considered the chief cause of the disease. The symptoms resemble those of liver rot, and include progressive anemia and great debility.

A tick disease which causes considerable mortality in sheep is apparently transmitted by a tick belonging to the genus Ornithoderos. The disease is of a chronic nature, and the symptoms include loss of wool, a cough, discharge at the nose, and general debility. The actual cause of the disease is at present uncertain.

Another disease of sheep and goats in India is known as juvee, and is characterized by diarrhea and excessive anemia. It is apparently a coccidiosis. The best method of prevention consists in the isolation of diseased animals and the avoidance where possible of wet pastures. The author has also made observations on a disease locally known as "wah," which somewhat resembles rinderpest.

Sheep pox in the district of Kulm, HAAKE (*Berlin. Tierärztl. Wchnschr.*, *1906, No. 48, pp. 855-857*).—The author describes the circumstances surrounding outbreaks of sheep pox, and comes to the conclusion that the spread of this and other highly infectious diseases is not sufficiently well controlled by mere announcement of the existence of the case in the usual columns of legal matter. It is suggested that the existence of such diseases should be at once announced in two or three newspapers of the widest circulation, in order that the matter might be promptly brought to the attention of all concerned.

Infectious cerebro-spinal meningitis, H. J. VAN DER SCHROEFF (*Tijdschr. Veeartsenijk.*, *34* (*1907*), *No. 4, pp. 242-244*).—The symptoms of this disease are briefly described, with particular attention to the differences in symptoms depending on whether the nervous form of the disease is developed or not.

Tetanus following enteritis, H. HOLTERBACH (*Berlin. Tierärztl. Wchnschr.*, *1906, No. 47, pp. 844-846*).—The conditions under which the tetanus bacillus gains entrance to warm-blooded animals are briefly discussed. A detailed statement is presented of the symptoms observed in a case of tetanus, in which infection apparently took place through the wall of the small intestines rendered particularly susceptible by a case of enteritis.

Pernicious anemia in horses, J. BEGHIN (*Ann. Méd. Vét.*, *55* (*1906*), *No. 12, pp. 692-694*).—A brief description is given of an enzootic outbreak of this disease with notes on the symptoms and the appearance of the blood. It was impossible to demonstrate either bacteria or other parasites in any of the cases

examined. The treatment consisted in isolation of the sick animals and a thorough disinfection of the premises.

A disease simulating dourine caused by filaria, H. T. Pease (*Jour. Trop. Vet. Sci., 1 (1906), No. 4, pp. 414–416*).—Notes are given on a few cases which have been observed among horses in which irregular plaques appeared on various parts of the skin together with other symptoms which closely resemble those of dourine. A careful study, however, showed that the cases were not dourine and that the animals did not readily spread contagion. An examination of the affected patches showed the presence of a filaria.

The interaction of Trypanosoma equiperdum and T. evansi, A. Lingard (*Jour. Trop. Vet. Sci., 1 (1906), No. 4, pp. 353–386, pls. 3*).—In the course of his study of trypanosome diseases the author found that mares which had successfully passed through an attack of dourine and resisted a second inoculation of the same disease do not thereby acquire any immunity to *T. evansi.* Similarly, ponies and donkeys, after recovering from dourine, succumb readily to surra. It appears, however, from experiments with donkeys that immunity acquired during pregnancy may be transmitted to the offspring.

Vaccination against swine plague and hog colera, O. Profé (Fortschr. *Vet. Hyg., 4 (1906), No. 8, pp. 169–176*).—A brief account is given of several of the sera which have been proposed for use in the treatment of this disease. In one instance where Klett's serum was used a cure was brought about in hogs which had just begun to show symptoms of swine plague and the disease was prevented from developing in exposed hogs. Of three hogs which were badly affected at the time of vaccination one recovered while the other two succumbed.

The pectoral form of swine plague, Enders (*Berlin. Tierärztl. Wchnschr., 1906, No. 49, pp. 867–870*).—On the basis of an extended study of different forms of swine plague the author comes to the conclusion that the catarrhal form of pulmonary inflammation in swine plague is the most frequent. It was also ascertained that there are cases of pleuritis of a specific and infectious nature due to swine plague, but without any evidence of pneumonia, and on the other hand there are cases of pneumonia due to swine plague which are of a catarrhal nature and in which the pleura is not affected. In some instances, the author observed swine plague in the form of an exclusive inflammation of the pleura without any involvement of the lungs.

The transmission of swine erysipelas, Schmuck (*Berlin. Tierärztl. Wchnschr., 1906, No. 47, p. 847*).—The author relates the circumstances of the infection of one of his hands while examining the heart of a hog dead of the disease. The infection spread downward along the thumb and upward to the wrist, after which the disease healed spontaneously.

The fluid of echinococci and cysticerci, E. Joest (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 2 (1906), No. 1, pp. 10–28*).—The bladder fluid of echinococci and *Cysticercus tenuicollis* when inoculated intravenously or into the body cavity produced no effect on experimental animals and therefore may be considered as containing no poisonous principle. It was further demonstrated that the blood serum of animals affected with echinococci and cysticerci exercises no precipitating effect upon the fluid of these parasites.

The occurrence of trichinæ in rats, L. Bahr (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 2 (1906), No. 1, pp. 62–65*).—Statistics are given on the occurrence of trichinæ in rats with especial reference to the connection between the parasitism of these animals and pigs. The author believes that in many instances the infestation of pigs with trichinæ can not be accounted for by supposing that they ate infested rats. This assumption becomes improbable when it is considered that high-grade hogs are commonly raised under conditions where they seldom have opportunity to eat rats. The author believes that

some of the infestation with trichinæ must be explained as occurring through the feces of infected hogs.

A study of rabies, STÜRTZBECHER (*Ztschr. Veterinärk., 18 (1906), No. 11, pp. 478–484*).—Notes are given on various methods of diagnosing rabies with particular reference to the importance of Negri's corpuscles. One of the most important practical points in the control of rabies is a certain means of reliable diagnosis. This, the author believes, is found in Negri's corpuscles.

Vaccination against rabies by the Pasteur method, R. NITSCH (*Centbl. Bakt. [etc.], 1. Abt., Orig., 42 (1906), Nos. 7, pp. 647–658; 8, pp. 775–783*).—The application of Pasteur's method in the control of rabies has been found to reduce decidedly the percentage of mortality from rabies in animals and man. The incubation period of the disease, however, appears not to be extended by the Pasteur treatment.

Dog distemper and the filterable organism of Carré, J. LIGNIÈRES (*Bul. Soc. Cent. Méd. Vét., 83 (1906), No. 22, pp. 622–630*).—As a result of his study of this disease, the author comes to the conclusion that there is a specific filterable organism in the body fluids of dogs affected with distemper, and that this organism is the principal cause of the distemper. There may be, however, other organisms, particularly *Pasteurella canis*, which, acting in connection with the specific organism of distemper, may cause complications or peculiar symptoms in the course of the disease.

Preliminary note on the development of Piroplasma canis in the tick, S. R. CHRISTOPHERS (*Brit. Med. Jour., 1907, No. 2402, pp. 76–78, figs. 26*).—Much difficulty has been experienced in following the life history of blood parasites in ticks. The author had opportunity to study this matter by reason of the unusual prevalence of canine piroplasmosis in India. The tick chiefly concerned in transmitting the disease was *Rhipicephalus sanguineus*. The various developmental stages are described and illustrated by the author, and it is suggested that the life history, as observed in *Piroplasma canis*, may be very similar to that of other related parasites.

Further studies on fowl plague, R. OSTERTAG and R. BUGGE (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 2 (1906), No. 1, pp. 1–9, fig. 1*).—It was determined by inoculation experiments that fowl plague may be transmitted to geese, and that in these birds the disease assumes a peculiar form showing pronounced cerebral symptoms, while the blood is not always infectious. It was found that the virus of fowl plague could be kept in the laboratory for at least 100 days without losing its virulence even when the material was subjected to light. The resistance of the virus to ordinary disinfectants is of average degree.

No success was had in cultivating the virus in collodion sacs inside the body cavity of fowls. It appears that fowls which have once recovered from the disease possess in their blood protective substances which, however, are of little strength.

The use of the pigeon for testing immune fowl cholera serum, A. BRAUN (*Fortschr. Vet. Hyg., 4 (1906), Nos. 8, pp. 174–183; 9, pp. 198–211*).—The pigeon has been extensively used as an experimental animal in the laboratory for testing the virulence of fowl cholera virus and the effectiveness of sera developed in studying this disease. The author made a careful study of the problem with the special object in view of determining the suitability of the pigeon in this work. The conclusion is reached that the pigeon is not suitable for testing fowl cholera serum chiefly for the reason that this bird appears to have a pronounced specific reaction to fowl cholera. The mouse, on the other hand, is well adapted for the purpose.

RURAL ENGINEERING.

Studies on the irrigation of Jauja, D. BALDIZAN (*Bol. Min. Fomento [Peru], Dir. Obras Pub., 2 (1906), No. 1, pp. 67, figs. 11, dgm. 1*).—These studies have been carried on in the valley of Jauja, which is traversed by the Mantaro River, but lacks the necessary precipitation to render the soil productive.

To supply 3,800 hectares of these lands with water and to provide water for the municipal and household purposes of the city of Jauja, with a probable population of 10,000 people, a canal is proposed which will divert 4,000 liters per second from the Mantaro River and carry it to the vicinity of Jauja. The length of the canal will be 21.9 kilometers, and it will have a grade varying from 1 meter in 1,000 in tunnels and rock cuts to 2 per 1,000 in the aqueducts and from 0.8 to 0.3 per 1,000 in the earth sections. Cross sections of the canal in various kinds of material are shown, Bazin's formula having been used in the determination of the area of cross section.

The distribution of water by measurement [R. G. KENNEDY]. ([*Proc. Irrig. Conference, Simla, 1904, 1, pp. 134–139*).—The disadvantages of the usual distribution of water according to area are cited and the proposed distribution by measure with its advantages and difficulties is discussed. The system of distribution and assessment by volume where the user is charged according to the number of acre-feet actually used is considered inapplicable in India, except in those cases where the water is distributed over a comparatively small and compact area situated in close proximity to the source of supply.

The "module system" is described as a system in which the cultivator pays a fixed rate for the volume of water allowed to pass through a sluice at prescribed intervals of time in sufficient quantity to mature the crop, the discharge of the sluice bearing a certain proportion to the area to be irrigated. By this system the charges during rainy seasons would be the same as during dry seasons. The module system is undeveloped, owing to the difficulties in devising modules, arranging a scale of charges, and overcoming the prejudices of irrigators.

Contributions from the agricultural experiment station of the University of Göttingen, VON SEELHORST (*Jour. Landw., 54 (1906), No. 4, pp. 313–342, pls. 2*).—From the experiments conducted on the relation between water evaporation and drainage in fallow soils, a table has been constructed from which the following conclusions are derived:

"In general, sandy soils give a greater quantity of drainage water for the same precipitation that do loam soils. Only in June and July of 1905 and in February of 1906 was the reverse true.

"Evaporation is always greater from a loam than from a sandy soil, which is due usually to the greater impermeability of the former to rain and its greater capillarity, which brings the water to the surface more readily in dry weather."

Further experiments have been carried on in the use of water upon rye, barley, wheat, and potatoes, the crops being grown in tanks and the amount of water actually used by the plant being computed from the amount of water received by rainfall after deductions are made for evaporation and drainage. Four tanks were employed with the loam soils, in three of which wheat, rye, and potatoes were grown with the remaining tank left fallow. The weights of the tanks were taken at frequent intervals. In computing the amount used by the plants it was found necessary to estimate the amount evaporated by the soil, since it was assumed that the evaporation from the fallow soil surface would not be the same as from the soil surface shaded by plants.

The results of the experiments indicate that on a loam soil wheat requires

333 gm. and rye 375 gm. of water per gm. of dry substance of grain, and that potatoes require 277.7 gm. of water per gm. of dry substance of the tubers, or 66.3 gm. of water per gm. of fresh tubers. On loam soil the water requirement of rye is greater in April and May than that of wheat, but from the end of May to the time of harvesting of wheat its water requirement is greater than that of rye. From the end of May to the 21st of June the water requirement of rye increases very rapidly; that of wheat less so. Both crops reach a maximum requirement on the 21st of June. The use of water by potatoes increases from the end of May to the 10th of July very rapidly and from this date to the first of August remains always uniform. It then decreases, first rapidly and then more slowly, until the time of harvesting.

For sandy soils experiments were conducted in the same manner as for loam soils. The results show that rye requires 482.2 gm. and barley 454 gm. of water per gm. of dry substance of grain, and that potatoes require 60 gm. of water per gm. of fresh tubers.

Plates are included giving a graphical representation of the daily use of water by the plants in each experiment.

Rural and urban hydraulics, G. BECHMANN (*Hydraulique Agricole et Urbaine. Paris: Librarie Polytechnique, 1905, pp. 634, figs. 373*).—The author has compiled a general text on the subject.

The first part of the book is devoted to a treatment of the means of securing, storing, conveying, and lifting water, while the second part takes up the relation of water to agriculture. In the latter connection the physiological rôle played by water in the growth of plants is considered in some detail, following which is the chapter devoted to the use of water in irrigation with particular reference to the methods of applying water and the conditions governing its distribution, division, and sale. The various units of measurement used in France are explained and their equivalents given.

The fertilization and improvement of land by the deposition of silt is considered, and particular attention is given to the reclamation of marshes in relation to the natural conditions and special legislation governing the construction of such works. Some examples of marsh reclamation in Belgium and elsewhere are described. The subject of drainage occupies a long chapter, the theory and methods of construction of drains being given, together with an abstract of the special legislation on the subject.

In part 3, city water supplies and sewage are considered, the various structures necessary being illustrated and described.

Good roads bulletin, H. E. BLAKESLEE (*Jackson, Miss.: Dept. Agr. and Com., 1906, pp. 23*).—A bulletin published with the "objects of furnishing accurate information as to what each county of Mississippi is doing to improve the public roads, and to create a sentiment of rivalry that will assist in a betterment of road conditions in general."

The number of miles of public roads in each county, the extent, methods, and cost of improvements, and local opinions of the value of different methods are given in tabular form, the bulletin being concluded by some information on the use of road drags, methods of road construction, and cost data.

The use of alcohol and gasoline in farm engines, C. E. LUCKE and S. M. WOODWARD (*U. S. Dept. Agr., Farmers' Bul. 277, pp. 40, figs. 12*).—In response to a widespread demand for information on the adaptability of alcohol as a fuel for use in internal-combustion engines used in farming operations, this Office carried on a series of experiments with a twofold object: (1) To determine what can be done with alcohol in existing engines and (2) to learn what changes in the mechanism of the engine are necessary to secure the highest efficiency in the use of alcohol as a fuel. The present bulletin is a popular discussion of

these experiments and of the mechanism and operation of gas engines in general with a short treatment of the comparative cost and relative adaptability of different fuels. The principal conclusions derived from the experiments are as follows:

"Any engine on the American market to-day, operating with gasoline or kerosene, can operate with alcohol fuel without any structural change whatever with proper manipulation.

"Alcohol contains approximately 0.6 of the heating value of gasoline, by weight, and in the Department's experiments a small engine required 1.8 times as much alcohol as gasoline per horsepower hour. This corresponds very closely with the relative heating value of the fuels, indicating principally the same thermal efficiency with the two when vaporization is complete. . . .

"The thermal efficiency of these engines can be improved when they are to be operated by alcohol, first, by altering the construction of the carbureter to accomplish complete vaporization and, second, by increasing the compression very materially. . . .

"The exhaust from the alcohol engine is less likely to be offensive than the exhaust from a gasoline or kerosene engine, although there will be some odor, due to lubricating oil and imperfect combustion, if the engine is not skillfully operated.

"It requires no more skill to operate an alcohol engine than one intended for gasoline or kerosene.

"There seems to be no tendency for the interior of an alcohol engine to become sooty, as is the case with gasoline and kerosene. . . .

"In most localities it is unlikely that alcohol power will be cheaper or as cheap as gasoline power for some time to come."

Windmill electric plant requirements (*Engin. Rec., 55 (1907), No. 2, p. 47*).—The essentials in installing a windmill electric plant have been stated by W. O. Horsnaill, of England, as follows:

First, to ascertain the average daily load in ampere-hours during periods of maximum current consumption; second, to provide a storage battery of a capacity at least double this output; third, to install a dynamo of sufficient capacity to charge this battery in 12 hours; fourth, to design a dynamo to deliver an approximately constant voltage throughout a wide range of variation of speed; fifth, to erect a windmill of ample size to run the dynamo at full load with a 10-mile-an-hour wind; and sixth, to fit the windmill dynamo and all gearing connections with roller-bearings or other friction-reducing means. A large number of plants built to these specifications are said to be in successful operation in England.

The production and utilization of low temperatures, L. MARCHIS (*Production et Utilisation du Froid. Paris: H. Dunod and E. Pinat, 1906, pp. IV+586, figs. 402*).—This work is intended to supply a want long felt in France for a general text on the subject of refrigeration.

The introduction takes up the subject of the development of the refrigerating industry showing the manifold uses to which ice is at present put and giving statistics on the extent to which refrigeration is carried on not only in the packing and allied industries but also in transportation by land and water in the various countries. Following this several chapters are devoted to the thermo-dynamic theory of refrigeration and to descriptions of the principles underlying the action of different machines and their design, particular attention being given to the machines of the compression type. Different forms of condensers and evaporators are described and illustrated and the circulating medium discussed.

Some special applications of the use of refrigeration in dairies and breweries

are considered, following which are given some theoretical and practical instructions on the construction of cold storage warehouses, etc., and the schemes of piping and ventilation employed. Refrigerating cars as used in various countries are described and the equipment necessary on shipboard is discussed in considerable detail. Factories for the commercial manufacture of ice are fully described, and the special equipment necessary in the refrigeration and conservation of meats, vegetables, fruit, fish, eggs, etc., is dealt with in a comprehensive way. An extended chapter on the utilization of low temperatures in the manufacture and transportation of dairy products completes the book.

RURAL ECONOMICS.

[Agriculture, immigration, and colonization in South Carolina], E. J. WATSON (*Ann. Rpt. Comr. Agr., Com. and Immig. S. C., 3 (1906), pp. 75, figs. 12, chart 1*).—This is the third report by the State commissioner of agriculture, commerce, and immigration.

The commissioner points out the increased value of agricultural lands and discusses the agriculture of the State, the advantages of South Carolina to prospective agricultural settlers, the work of the department in the selection, importation, and care of immigrants from European countries, and the present status of the agricultural colonies now in operation in different sections of the State.

Agriculture in Italy, A. B. BUTMAN (*Daily Consular and Trade Rpts. [U. S.], 1907, No. 2812, pp. 1–3*).—In addition to notes on fruit and rice culture, poultry raising, and the production of other crops in Italy, this article discusses present labor conditions and presents statistics on the results of cooperation among farmers. At the close of 1905 the number of cooperative leagues was 982, with a membership of 221,913.

Agricultural Algeria in 1906, L. TRABUT and R. MARÈS (*L'Algerie Agricole en 1906. Algeria: Govt., 1906, pp. 531, pls. 5, figs. 77*).—This treatise describes quite fully the natural regions of Algeria, the soil, the water supply, cereal and forage crops and their methods of culture, viticulture, arboriculture, culture of tobacco, textiles and other industrial plants, ornamentals, vegetable culture, forests, animal production, agricultural education, agricultural credit and insurance, the steppes and Sahara. Detailed statistical matter is given in an appendix.

The agricultural credit banks were established in Algiers in 1901, and there were in March, 1905, 25 district mutual banks with 95 affiliated local banks for cooperative credit. The business transacted in 1904 was estimated at 2,893,171 francs.

Agricultural incomes in Switzerland, P. VAN BIERVLIET (*Rev. Gén. Agron., n. ser., 1 (1906), No. 12, pp. 542–544*).—This article reviews the results of a recent inquiry by the department of agriculture as to the incomes from small, moderate, and extensive farming in Switzerland.

For 1904 the average comparative net incomes were estimated as follows: Small farming, 2.55 per cent; moderate farming, operations of small, ordinary, and great importance, 2.63, 3.02, and 3.77 per cent, respectively; extensive farming, 3.52 per cent. The total income of farmers, including value of labor and interest on invested capital, averaged in 1904 3.49 francs per day. "These figures show that Swiss agriculture is not very remunerative," and it is attributed to the increased cost of labor and other elements entering into the cost of production.

Agricultural statistics of the Canton of Bern for 1904 and 1905 (*Mitt. Bern. Statis. Bur., 1906, No. 1, pp. 177*).—Statistics of acreage under cultiva-

tion and the yields and prices of cereals, vegetables, and fruits are reported. Notes are also given on the weather conditions in the different districts during the growing season and their bearing on crop production.

Investigations on the economic development and distribution of wealth in the Canton of Bern, C. MÜHLEMANN (*Mitt. Bern. Statis. Bur., 1905, No. 2, pp. VIII+281*).—This is a general review of the history of the Canton of Bern, with more particular reference to its economic development.

Chapter 8 is devoted to a survey of agricultural development during the 19th century. The subjects treated include the production and sale of live stock; changes in systems of farm management and cultivation of land with especial reference to crop production; real estate and mortgages, agricultural credit and liens with a discussion of the causes and the consequences of indebtedness, and the advancement of agriculture by means of private, cooperative, and State aid. Statistics are presented to show the progress made during this period.

The farm help problem, A. H. SANDERS (*Breeder's Gaz., 51 (1907), No. 15, p. 531*).—The writer discusses the lack of competent farm help in the United States and other countries, points out some of the causes of this deficiency, and calls attention to the advantages offered to farm hands in this country. The greater dissemination of information on the latter point among agricultural laborers in foreign lands is regarded as likely to induce the emigration of competent help to the United States.

Farming on shares, D. ZOLLA (*Ann. Soc. Synd. Libre Agr. Périgord, 9 (1907), No. 2, pp. 20–28*).—The author defends the system of farming on shares as compared with payment in wages to agricultural laborers in France.

The author takes two typical illustrations of metayers with families in different provinces renting farms of which 26 and 33 hectares only were cultivated. The actual net returns from both farms and the shares to metayers and proprietors are given, and the financial results to the metayers compared with what could have been received in wages during 300 working days. The advantage of share farming over the wage system was estimated at 86 per cent. In addition to this financial gain the author enumerates other economic and social benefits arising only as a result of the metayer system which are enjoyed by the 344,000 metayers in France. At the same time the character of the proprietor and the efficiency of the farmer are regarded as important factors in securing the best returns under this system.

Report of the small holdings committee (*Jour. Bd. Agr. [London], 13 (1907), No. 10, pp. 597–604*).—This is an abstract of the report of the departmental committee appointed by the president of the Board of Agriculture and Fisheries, in April, 1905, to inquire into the administration and working of the Small Holdings Act of 1892.

After examining 58 witnesses and visiting a number of small holdings in Great Britain, the committee recommends among other things the direct control by a government department of the holdings with authority to make definite experiments, the amendment of the act for the greater protection and benefit of the small holder, the advancement of government loans to landowners at the lowest possible rate of interest to enable them to undertake the equipment of small holdings, the increase of State funds for agricultural instruction in rural districts, and promotion of all forms of agricultural cooperation by means of government loans on approved security of a central credit association.

The law authorizing loans to agricultural cooperative societies (*Bul. Statis. Lég. Compar., 31 (1907), No. 1, pp. 14–17; Bul. Mens. Off. Renseig. Agr. [Paris], 6 (1907), No. 2, pp. 133–135*).—The text of the law of December 29, 1906, amending the law of March 31, 1899, regulating the control of the 40,000,000 francs advanced by the French government to the regional banks

without interest. Through the district or regional banks loans are made to mutual credit banks and agricultural cooperative societies.

An agricultural cooperative society, D. L. de Castro (*Rev. Agron. [Portugal], 4 (1906), No. 2, pp. 357–363*).—This is a history of an agricultural cooperative society in Portugal since its origin in 1897. The author describes its development, the extent of its operations, and its objects. The latter conform largely to the aims of such organizations in Europe, namely, improvement of cultural methods, guaranties of pure seed, purchase of implements and machinery, formation of agricultural credit banks, mutual insurance, etc.

The development of agricultural cooperative societies in Germany, C. Neumann (*Fühling's Landw. Ztg., 55 (1906), No. 22, pp. 764–773*).—Statistics are presented and discussed relating to the growth of rural associations in Germany. Data for 1905–6 regarding membership, value of property, amount of investments, profits, rates of interest, deposits, etc., are compared with preceding years. The associations are steadily growing in numbers and in influence, and are said to be an uplifting force in the economic life of the rural population.

Costs of hauling crops from farms to shipping points, F. Andrews (*U. S. Dept. Agr., Bur. Statis. Bul. 49, pp. 63*).—The information contained in this bulletin was secured from correspondents in 1,894 counties in different States. The statistics deal particularly with 23 of the staple agricultural products grown in the United States and embrace the number of counties reporting, average miles to shipping, weight per load, cost per ton per mile, etc.

In a summary of these data the author says: "The average costs per 100 lbs. for hauling products from farms to shipping points vary in a number of instances roughly with the relative values of the articles hauled, the more valuable product being hauled often at greater cost than the less valuable product. Corn, wheat, oats, hay, and potatoes were hauled at costs ranging from 7 to 9 cts. per 100 lbs., cotton 16 cts., and wool 44 cts. per 100 lbs. Tobacco and hogs, however, cost only 10 cts. per 100 lbs. to be hauled from farms. The difference in cost of hauling between one product and another is largely due to the relative distance traversed and the relative size of load taken."

Statistics are also presented and discussed regarding the farmers' longest hauls and methods of hauling, with the effect of these factors on local and general prices. The quantity of farm produce hauled in 1905–6 is estimated at more than 49,000,000 tons and the cost of hauling at about $84,684,000 for the most important crops mentioned. The value of better roads, quicker methods of loading and unloading, and other factors are also discussed in their bearing on the reduction in the cost of hauling.

Notes from correspondents regarding the conditions of wagon transportations in different parts of the United States are also appended.

The grain trade, the basis upon which it is conducted, and the methods used in the different countries of the world, A. Deutschländer and W. Kunis (*Der Handel mit Getreide, seine Einrichtungen und Grundlagen in allen massgebenden Ländern der Erde. Leipsic: M. Schäfer, 1906, pp. 430*).—This book contains detailed information on the extent of cereal culture and yield, exports and imports, consumption, methods employed in different grain markets, freight rates, etc. The numerous tables show the acreage and yields of wheat, rye, barley, oats, and corn; their consumption in the most important countries; the weekly average prices in the principal markets of the world in 1904 and 1905; the shipments, variation in quantity, and visible supplies of cereals each week from 1895 to March, 1906; the monthly shipments from 1895 to 1903; and other statistical data. The object is to present definite information useful to the grain trade.

Crop Reporter (*U. S. Dept. Agr., Bur. Statis. Crop Reporter, 9 (1907), No. 3, pp. 17-24*).—In addition to the usual statistics and information on the condition of crops in the United States and foreign countries, this number has special articles on the cotton crop of the United States, 1790-1905, the monthly cotton crop situation, season of 1906-7, compared with preceding seasons; the wheat crop of various countries, 1902-1906; the flax crop of various countries, 1903-1905, etc.

AGRICULTURAL EDUCATION.

Report of the extension work of the [Rhode Island] College, A. E. STENE (*Bul. R. I. Col. Agr. and Mech. Arts, 2 (1906), No. 2, pt. 2, pp. 20, pl. 4*).—This is a report on the demonstration work for 1905-6, and includes articles on cooperative experiments in different parts of the State, extension lectures, special lectures, correspondence courses, popular bulletins, traveling libraries, the assistance of the grange, nature study, school gardens, and other miscellaneous work. In a "carpet-bag campaign," a representative of the college went from house to house and held neighborhood meetings (1) to give instruction in agricultural principles and suggestions of better methods, and (2) to ascertain just what are the principal difficulties, as well as the attitude of the farmer toward his vocation. There is also a report on the hydrocyanic-acid gas as a treatment for injurious insects, followed by suggestions for users of this remedy.

Report of the president, J. L. SNYDER (*[Mich.] Agr. Col. Bul. 1 (1906), No. 5, pp. 23*).—This report, in addition to the usual data concerning the work of the college during the fiscal year ended June 30, 1906, contains historical matter relating to the establishment of the college, the attendance during the past ten years, the preparation of students for admission, their sources of support and proposed occupation after leaving college, the development of experimental investigations, history of the experiment station, the history of farmers' institutes in the State, and an announcement of the semicentennial celebration to occur May 28-31, 1907.

It is shown that 78 per cent of those entering college during the year had attended high schools, that 27 per cent depend upon themselves for support while in college, and that 12 per cent intend to follow farming, forestry, or horticulture, while 52 per cent are uncertain as to their future occupation.

Report of the principal, 1906, H. B. FRISSELL (*Hampton Bul., 2 (1906), No. 2, pp. 30, figs. 6*).—The principal of the Hampton Normal and Agricultural Institute in his report for 1905-6 calls attention to the fact that of the 1,310 graduates of the school 85 per cent have taught at some time since leaving school. The three-year academic and industrial courses have been changed to four-year courses, and the courses in normal training, agriculture, trade, business methods, domestic science, and domestic art are continued.

Of the students enrolled in 1905-6, 39 per cent were from country schools, 50 per cent came from the country or small villages, and 34 per cent were from farms. The average acreage of these farms was 99 acres as against 57 acres in the preceding year. Sixty-eight per cent of the parents of these pupils owned their homes and an additional 10 per cent were buying homes, while 32 per cent of all the pupils came from houses of 7 rooms or more. These figures show an increase in the number of students from the country and an improvement in homes, as well as a larger ownership of land on the part of parents.

The report includes reports from the academic, agricultural, and home training departments, the trade school, military instruction and discipline, religious work, the library, museum, and other features of school work. The professor of agriculture reports that two new instructors have been added in the agricul-

tural department, and that a barn costing $30,000 has been erected. He outlines the revised course in agriculture, and recommends the purchase of improved live stock for instructional purposes.

Agricultural education, H. O. SAMPSON (*Ann. Rpt. Penn. Dept. Agr., 11 (1905), pp. 621-623*).—An address in which the college courses in agriculture are outlined briefly, and some data concerning the progress in the development of secondary courses in agriculture are given.

Proceedings of the course for agricultural teachers (*Stockholm: Dept. Agr., 1906, pp. 366*).—This volume contains lectures and discussions given at the course for teachers of agriculture in Stockholm, Sweden, September 18–23, 1905. The topics of the lectures are The Importance of Green Manuring and How Practiced, by N. L. Forsberg; The Arrangement of Demonstration Plats and Their Application as Instructional Material, by N. H. Nilsson; Inoculation and Serum Therapy in Combating Diseases of Farm Animals, by J. Svensson; The Teachings of Recent Experiments and Experiences as to the Application of Artificial Fertilizers, by M. Weibull; The Arrangement of Practical Fertilizer Field Trials, by P. Bolin; The Importance of Keeping Accurate Accounts in the Dairy Industry, by G. Liljhagen; Recent Agricultural Machinery and Its Use on the Farm, by G. Timberg et al.; Some Problems in Animal Nutrition, by H. Winberg; Changes in Systems of Crop Rotation Made During Recent Years, by J. A. Sjöström; Crop Rotations, by N. L. Forsberg; Cooperative Purchasing and Sales Associations, by G. Lenfven; Recent Progress in Butter Making, by N. Engström; Successful Butter Exports, by Fr. Bagge; Recent Investigations in Dairy Bacteriology, by Chr. Barthel; The Care and Application of Barnyard Manure, by H. G. Söderbaum; Recent Progress in the Manufacture of Cheese, by L. F. Rosengren; Proposed Changes in the Bookkeeping of Control Test Associations, by Nils Hansson and H. Funkquist; Courses for Practical Farmers, by H. Juhlin-Dannefelt et al.; Award of Prizes for Small Farms, by Nils Hansson; and Traveling Stipends for Small Farmers.—F. W. WOLL.

The Macdonald movement, J. W. ROBERTSON (*Rpt. Women's Insts. Ontario, 1906, pp. 54-59*).—An address given at the annual convention of the Women's Institutes held at Macdonald College, December 13 and 14, 1905, in which the general features of the Macdonald movement are outlined, and a description is given of Macdonald College with its departments of farms, research, and instruction.

Outline of a course of study and reading on soil and its management, H. C. PRICE (*Ohio State Grange Ed. Bul. [1], pp. 7-12*).—This is a course of study prepared for members of the Ohio State Grange, and consists of 18 lessons based on Vol. I of Brooks's Agriculture.

Sanitation, MARY E. LEE (*Ohio State Grange Ed. Bul. [1], pp. 13-16*).—A course of 14 lessons based on Mrs. E. H. Richards Home Sanitation, and intended for members of the Ohio State Grange.

Qualifications necessary for teaching agriculture in common schools, C. A. MCNABB (*Bien. Rpt. Okla. Bd. Agr., 2 (1905-6), pp. 279-285*).—An address before the Teachers' County Institute at Oklahoma City, in which the position is taken that while the teachers will not be expected to teach the practice of agriculture, they should be familiar with this side of the question and should also inform themselves on the work of the U. S. Department of Agriculture, the experiment stations, and the agricultural colleges. They should be up to date in their ideas of farm methods, improved implements, etc. To secure this training he recommends that they read farm journals and the publications of this Department and the experiment stations.

Agriculture in the common schools, W. M. GRISSOM (*School News and Pract. Ed., 20 (1907), No. 7, pp. 312, 313*).—An argument for changes in the school curriculum which will relate the instruction to life problems either through instruction in elementary agriculture or through modification of arithmetic, geography, and other subjects, to make them apply more directly to rural conditions.

Country life education, W. M. HAYS (*U. S. Dept. Agr., Office Expt. Stas. Circ. 73, pp. 13*).—This is an address by W. M. Hays before the Pennsylvania State Board of Agriculture January 23, 1907, in which he discusses the new school movement springing out of the land-grant act of 1862 and subsequent acts of Congress for the aid of colleges of agriculture and mechanic arts, and the proposition to extend Government aid to agricultural high schools, mechanic arts instruction in city high schools, and home economics instruction in both country and city.

Annual report Winnebago County Schools, 1906, O. J. KERN (*Rockford, Ill.: Author, 1906, pp. 96, figs. 104, map 1, dgms. 7*).—This report includes the following chapters: (1) The improvement of school grounds and buildings—a series of reports of things done and not done in the country-school districts of Winnebago County in the way of tree planting and otherwise improving the school grounds; (2) school gardens and elementary agriculture—sixty districts did school garden work in 1906 for the purpose of beautifying school grounds, making children acquainted with plant life, soils, conservation of moisture, protection from injurious insects, etc., and making the child a more efficient factor in the home garden work; (3) Winnebago County Farmer Boys' Experiment Club and Girls' Home Culture Club, including reports on various contests; (4) manual training in the country school; (5) books and pictures, with special reference to the 81 traveling libraries which circulate in rural districts of the county; (6) some statistics of the rural schools, and (7) the problem of consolidation of country schools.

Home science and the school curriculum, MARY C. MACPHERSON (*Rpt. Women's Insts. Ontario, 1906, pp. 102–106*).—An address before the annual convention of the Women's Institutes of Ontario, held at Macdonald College December 13 and 14, 1905, showing how home science may be taught in relation to other subjects in the school curriculum.

What form of industrial training is most practical and best suited to the country child? O. J. KERN (*El. School Teacher, 7 (1907), No. 6, pp. 323–328*).—The writer considers the educational value and practicability of teaching elementary agriculture, manual training, and home economics in the country schools.

The improvement of our rural schools and their surroundings, E. E. BALCOMB (*Bien. Rpt. Okla. Bd. Agr., 2 (1905–6), pp. 317–347, figs. 38*).—This paper is devoted to suggestions for the improvement of school buildings inside and out and the improvement of school grounds by means of planting trees, shrubbery, vines, and flowers. Many specific suggestions of means for bringing about these improvements are given, and the numerous illustrations aid in making these suggestions clear and forceful.

School grounds and school gardens, R. A. EMERSON (*Bul. Nebr. State Hort. Soc., Nos. 4, pp. 11, figs. 2; 5, pp. 11, figs. 3*).—Part 1 of this article is devoted to the planning of school grounds with reference to playgrounds, trees, shrubs, flowers, lawns, school gardens, and nurseries, and to suggestions and directions for planting and caring for trees and shrubbery.

Part 2 contains a discussion of school gardens which may or may not be located on the school grounds. How to prepare the ground, what, when, and

how to plant, and how to care for the school gardens are the principal topics discussed.

Gardening for schools, S. B. McCready (*Ontario Agr. Col. and Expt. Farm Bul. 152, pp. 32, figs. 4, maps 2*).—This is one of the series of provincial teachers' bulletins, and treats of the place of gardening in education, cooperative experiments in agriculture, forestry, and horticulture, and children's home gardening organizations.

Gardening, W. J. Green (*Ohio State Grange Ed. Bul. 2, pp. 12–16*).—A course prepared for members of the Ohio State Grange, consisting of 18 lessons based on Green's Vegetable Gardening.

A course of study in farm crops, C. A. McCall (*Ohio State Grange Ed. Bul. 2, pp. 6–11*).—A course of study prepared for the members of the Ohio State Grange, consisting of 17 lessons based on Vol. II of Brooks's Agriculture.

Improvement of the corn crop, J. A. Foord (*Agr. Col. Ext. Bul.* [*Ohio State Univ.*], *2 (1907), No. 7, pp. 16, figs. 14, dgm. 1*).—Directions are given for selecting and making germination tests of seed corn.

Studies of corn and its uses, F. H. Rankin (*Agr. Col. Ext. Univ. Ill.* [*Circ.*], *1906, Oct., 2. ed., pp. 40, figs. 5*).—These include suggestions for studies by young people of the corn plant, studies of an ear of corn, preparing exhibits and using the score card for corn and for oats, studies of the different parts of a kernel of corn, commercial products of corn, and suggestions for 6 experiments with corn.

Report of the corn contest, E. C. Bishop (*Ann. Rpt. Nebr. Bd. Agr., 1905, pp. 184–197*).—This article gives particulars regarding the origin, progress, and final exhibition program and banquet of the Nebraska corn growing contest.

Tillage and cultivation, A. G. McCall (*Agr. Col. Ext. Bul.* [*Ohio State Univ.*], *1 (1906), No. 9, pp. 12, figs. 11*).—A lesson in elementary agriculture, with suggestions for a number of experiments with soils.

Practical experiments with milk and butter, J. W. Decker (*Agr. Col. Ext. Bul.* [*Ohio State Univ.*], *2 (1906), No. 4, pp. 9–13, figs. 8*).—Ten experiments suitable for use in elementary schools are given. These illustrate the presence of water, organic matter, and mineral matter in milk, the separation of curd and whey, the presence of albumen and milk sugar in whey, the separation of butter fat from cream, the presence of casein in butter, tests to distinguish between butter and oleomargarine, and the effect of heat and cold on the keeping quality of milk.

Outline of course in nature study, L. H. Miller and E. B. Babcock (*Training Dept., Los Angeles Normal School, 1906, pp. 16*).—The general purpose of the nature-study work in this school is "to bring the child and nature into the most vital contact possible."

The course includes work with plants, animals, and nature-study literature. Both wild and cultivated plants are studied—to be able to recognize them, to know what they do, to become familiar with the life history of certain ones, to acquire knowledge of the cultivation of common vegetables and flowers, and to take up eventually some of the more special phases of plant production. The means employed in acquiring this information are the school garden, home gardens, and field trips and observations.

A like comprehensive study of the more common animals—birds, mammals, toads, insects, etc.—and the proper care and treatment of them, is taken up in the schoolroom, at home, and on trips afield.

The outline of nature-study work in detail was prepared by B. M. Davis, and includes work for each term and grade through the eight years of common school work. The work of the seventh grade consists largely of experiments in

elementary agriculture on such topics as soils, soils and water, soil and the plant root, and fundamentals of plant physiology. This work is supplemented by excursions in the field and the study of the great agricultural industries correlated with United States history. In the eighth grade laboratory and text-book work in human physiology takes the place of similar work in agriculture, but the garden work, with varieties of plants for the purpose of showing plant improvement, seed selection, crop rotation, green manures, and soil inoculation, is continued.

The outline includes numerous references to text-books and other literature germane to the topic under consideration.

Practical nature study, F. E. BROOKS (*W. Va. School Jour., 35 (1907), No. 10, pp. 9, 10*).—A description of the shrew, its habits, and economic importance.

Direct methods of studying nature, LILIAN J. CLARKE (*Nature-Study Rev., 2 (1906), No. 9, pp. 302–310*).—This article, reprinted from *The Windsor Magazine*, is a description of the nature-study work at the James Allen's Girls' School, Dulwich, England. This is an endowed secondary school, and the girls in it are not being trained for any particular profession.

School garden work has been carried on for many years and has developed to an area containing plats owned by more than 140 girls. Some of these are plats containing families of plants, others are flower gardens, vegetable gardens, gardens showing plant associations, etc. There is also a plant laboratory with glass roof. The students do the practical work in the gardens, and study the relation of insects to pollination and fruiting, the classification of plants, which is greatly facilitated by the plats containing orders or families of plants, cookery in connection with the growing of kitchen vegetables, soils and the use of legumes and fertilizers, fruits, methods of seed dispersal, ecology, and other things relating to the physiology and pathology of plants

Hints on making nature collections in high schools, W. H. MULDREW (*Ontario Agr. Col. and Expt. Farm Bul. 134, pp. 32, figs. 20*).—This bulletin is in its second edition, having been revised by S. B. McCready, of the Macdonald Institute. It contains an outline for nature-study work in public schools, suggestions for phenological observations, for making live collections, collections of pressed plants, seeds, fruits, wood, insects, historical specimens, etc.

Nature-study work with insects, C. F. HODGE (*Nature-Study Rev., 2 (1906), No. 8, pp. 265–270, figs. 2*).—Suggestions for nature-study life history work with insects and a description of suitable cases for preserving life history sets.

Nature studies with birds for the elementary school, R. W. HEGNER (*El. School Teacher, 7 (1907), No. 6, pp. 348–354*).—The subject of bird protection is considered, together with reasons for the absence of birds and how to attract birds. A bibliography is appended.

A day's work in bird-land, EDNA R. THAYER (*Nature-Study Rev., 2 (1906), No. 9, pp. 289–295*).—This is a record of observations on the feeding habits of birds conducted under the direction of C. F. Hodge, of Clark University, by students at the biological station at the University of Indiana at Winona Lake, in July, 1906. Relays of students placed themselves in position to observe constantly from daylight to dark of one day the nests of an orchard oriole, a pewee, a phœbe, and a wren.

In the nest of the orchard oriole were two young birds which during the 15 hours and 17 minutes of observation were fed 69 times, 5 times only by the male bird. The food consisted principally of locusts and green caterpillars.

The pewee's nest contained 2 eggs, so the food collected by the female was for herself. During the day she caught 208 insects, and spent a total of 5 hours and 35 minutes in incubation, the average length of resting on the nest

being 10 minutes. The male visited the nest frequently and devoted himself to keeping away sparrows and other intruders.

The nest of the phœbe contained 2 young birds 4 days old. The female left the nest at 4.20 a. m., and between that time and 7 p. m., when it began to rain, the birds fed their young 260 times.

Observations on the wren's nest were not begun until 9.20 a. m., and ended at 6.46 p. m., when it began to rain. There were 5 young birds about 3 days old in the nest, and in the 9 hours and 26 minutes under observation they were fed 113 times, 91 times by the male and 22 times by the female. In most cases the male gave the food to the female who then distributed it among the young. The food consisted of cutworms, grasshoppers, cabbage worms, and black insects which were not identified. This nest was observed again 4 days later from 4.24 a. m. to 7.38 p. m. On this day the female did not brood her young so much, but fed them 130 times out of the 230 times that they received food.

MISCELLANEOUS.

Nineteenth Annual Report of Alabama College Station, 1906 (*Alabama Col. Sta. Rpt. 1906, pp. 36*).—This includes the organization list of the station, a financial statement for the fiscal year ended June 30, 1906, and reports of the director and heads of departments covering the work of the station during the year.

Nineteenth Annual Report of Michigan Station, 1906 (*Michigan Sta. Rpt. 1906, pp. 93–337*).—This contains a financial statement for the fiscal year ended June 30, 1906, reports of the director and heads of departments on the work of the station during the year, meteorological observations noted elsewhere, and reprints of Bulletins 232–238 and Special Bulletins 34 and 35.

Twenty-fourth Annual Report of New York State Station, 1905 (*New York State Sta. Rpt. 1905, pp. 405*).—The report comprises a financial statement for the year ended September 30, 1905, a list of periodicals received by the station, meteorological observations noted elsewhere, and reprints of most of the bulletins of the station issued during the year.

Experiment Station Work, XXXIX (*U. S. Dept. Agr., Farmers' Bul. 276, pp. 32, figs. 2*).—This number contains articles on the following subjects: Improvements in peach growing; mulberries; alfalfa in the eastern States; oat culture in the South; improvement of grass land; succotash as a soiling crop; tankage and bone meal for hogs; grinding corn for hogs; dips as lice killers; digestibility of fish and poultry; honey vinegar; and the farm woodlot.

Yearbook of the German Agricultural Association, 1906 (*Jahrb. Deut. Landw. Gesell., 21 (1906), pp. XIX+436+422*).—A report of the proceedings of the three meetings of this association held during the year. There is also an account of the twentieth movable agricultural exhibit of the association.

NOTES.

Colorado College and Station.—F. E. Brooks, a member of the last Congress, and J. L. Brush, formerly lieutenant-governor of the State, have been appointed on the State board of agriculture, in succession to P. F. Sharp and Harlan Thomas. B. F. Rockafellow has been elected president of the board. The courses in veterinary science and electrical engineering which were discontinued on account of lack of funds are to be reinstated.

An appropriation was made by the legislature for the purchase of land for the college and station, and the use of 10 per cent of the funds arising from the sale of lands under the original Morrill Act was authorized for the same purpose. The station will receive $27,500 for the ensuing biennium, provision being made for work in animal, plant, and fruit industry, horse breeding, and diseases of live stock. The fruit studies on the Western Slope are to be continued, and additional work is planned with potatoes at Greeley.

Successful short courses were held during the winter in forestry, horticulture, and domestic science. H. M. Cottrell has been placed in charge of the extension work and farmers' institutes, being succeeded as animal husbandman by G. E. Morton, of the Wyoming University and Station, as previously announced.

Florida Station.—Everest J. Macy, a graduate of Earlham College, has been elected assistant chemist, and began his duties May 1. William Hess has been appointed gardener.

Illinois University and Station.—L. H. Kerrick, for four years a trustee and on the day before his death elected president of the board, died March 13.

Indiana Station.—The State board of agriculture has granted the station the sole use of one of the large buildings on the State fair grounds. The building will be remodeled and equipped to accommodate the station exhibits and a working dairy, and to provide an auditorium for illustrated lectures. It is hoped that a large number of the people of the State will be brought into close touch with the work of the station in this way.

Kansas College and Station.—An act was passed by the recent legislature authorizing the board of county commissioners of any county in which a substation has been or shall be established by the board of regents of the college to purchase, on the petition of one-half of the legal voters of the county, a tract of land not exceeding 320 acres, at a cost of not over $5,000, for lease or donation for experimental purposes, and to levy a tax in payment. Under another recent law, which provides for the nomination of the State dairy commissioner by the secretary of the State board of agriculture, the director of the station, and the professor of dairy husbandry, J. C. Kendall, of the North Carolina College and Station, has been appointed. M. D. Snodgrass, a recent graduate and assistant in crop production, has been appointed assistant in the Alaska Stations and assigned to the breeding station at Kadiak Island, to begin work June 1. C. K. McClelland, of the Farm Management branch of the Bureau of Plant Industry, has been appointed superintendent of the branch station at Fort Hays.

Louisiana Stations.—In cooperation with the cerealist of the Bureau of Plant

Industry of this Department a large number of varieties of rice have been planted at Crowley and fertilizer trials are being carried on. Considerable local interest is being manifested in this work, and it is probable that the next legislature will make provision either for extending it or for establishing a permanent rice experiment station. J. B. Garrett has been appointed acting assistant director at Calhoun during the leave of absence of J. G. Lee.

Maine Station.—Dr. Raymond Pearl, instructor in zoology in the University of Pennsylvania, has accepted an appointment as biologist, to begin with the next academic year. The appointment is made under the provisions of the Adams Act, and the work will consist entirely of research in plant and animal breeding. Special attention will be devoted to an investigation of the principles of inheritance in poultry, the practical phases of which have already been extensively developed at the station.

Maryland Station.—*Students' Herald* notes the resignation of W. B. Thurston as assistant dairyman to enter commercial work.

Massachusetts College and Station.—Merritt I. Wheeler, trustee for many years, died April 7, and Hon. Frank Gerrett, of Greenfield, has been appointed on the board. H. J. Franklin and J. N. Summers have been appointed assistants in entomology. The former is to carry on the study of cranberry insects, with headquarters at Wareham. At a recent conference with representatives of the Massachusetts Cranberry Growers' Association much interest was manifested in the experiments under way, and the association volunteered to provide, at its own expense, a bog for use in the work. W. E. Dickinson has been appointed assistant chemist in connection with the fertilizer inspection, dating from July 1. C. P. Halligan, assistant horticulturist, has resigned to accept a similar position at the Michigan Agricultural College.

Missouri University and Station.—J. M. Stedman, entomologist, has been granted leave of absence for 17 months, a part of which will be spent in research at the Naples Zoological Station. C. H. Hechler, assistant in animal husbandry, has resigned to enter commercial work.

New Hampshire College and Station.—W. H. Pew, a graduate of the Iowa College, has been elected assistant professor of animal husbandry in the college and animal husbandman in the station, and F. Rasmussen, assistant in dairying in the Iowa College and Station, has been elected associate professor in dairying in the college and dairyman in the station. A department of botany has been organized in the station, in charge of Charles Brooks as botanist.

New Jersey College and Stations.—*Breeders' Gazette* states that F. C. Minkler, a graduate of the Iowa College, has been elected professor of animal husbandry. Charles S. Cathcart, several years ago a member of the station staff, and since that time in fertilizer work, has been appointed chemist.

New Mexico College and Station.—R. R. Larkin and Hiram Hadley have succeeded H. B. Holt and G. A. Richardson on the board of regents. P. D. Southworth, a graduate of the Minnesota College of Agriculture, has been appointed assistant in animal husbandry in the college and station. Courses in civil and electrical engineering have been added to the college curriculum, and a department of irrigation engineering has been organized under the direction of B. P. Fleming, of this Office, as previously announced. W. O. Bryant will have charge of the irrigation work until July 1. Farmers' institutes have been held during the winter and spring in practically all of the agricultural districts of the Territory, and farmers' institute societies have been organized in most of the localities.

Cornell University.—According to a recent note in *American Agriculturist*, an investigation in farm management is being conducted by M. C. Burritt

under the direction of T. F. Hunt. The object of the work is to determine not only what incomes are received from investments of from \$6,000 to \$20,000, but also, if possible, what classes of investments give relatively the best returns.

We note from press reports the dedication of the new buildings of the college of agriculture on April 27, in conjunction with the celebration of the centennial anniversary of the birth of Ezra Cornell. Addresses were delivered by President Schurman, Governor Hughes, Ex-Governor Woodford, N. J. Bachelder, master of the National Grange, and Dean Bailey.

North Carolina College and Station.—At the recent session of the legislature the management of the college and station, previously assigned to the State board of agriculture, was vested in a new board of control of 16 members. This board is entirely distinct from the State board of agriculture, which will continue to direct the experimental work of the State department of agriculture.

Pennsylvania College and Station.—B. E. Fernow, who had temporarily accepted the professorship of forestry, has been appointed dean of the faculty of forestry at the University of Toronto, where, according to a note in *Science*, it is proposed to organize the most complete system of forestry education on this continent. It is expected that a large forest reservation will be set aside for the use of the Toronto school, and university extension work of the broadest kind is contemplated.

M. H. Pingree and P. W. Flint have resigned from the station staff, and G. C. Watson, agriculturist, has been given leave of absence until August 1, 1908. F. S. Putney, assistant in agronomy and animal industry, has been transferred to the division of animal nutrition. Recent appointments include, in the station, Albert R. Merz as assistant chemist and Robert A. Lichtenthaler as assistant in animal nutrition; and in the college, John P. Stewart as assistant professor of experimental horticulture, who is making a special study of the apple in Pennsylvania.

Texas College and Station.—E. C. Green, instructor in horticulture in the college and assistant horticulturist of the station, has been placed in charge of the Texas Plant Introduction Garden at Brownsville, a branch of the Bureau of Plant Industry of this Department.

The total appropriation for the college and station for the ensuing biennium aggregates \$346,370, by far the largest appropriation in the history of the college. Of this amount \$2,000 is for publications, \$14,000 for the two substations. The remainder is for repairs and new buildings, including a farm-implement building to cost \$4,000, a dormitory, an engineering building, a natatorium, a veterinary hospital, and live-stock sheds. The increased appropriation will enable the college to strengthen much of the work already under way and to establish new departments, especially a department of agricultural extension work.

C. H. Alvord has been elected to the chair of agriculture in the college, vice F. S. Johnston, resigned. Mr. Alvord was assistant professor of agriculture at the college in 1901 and 1902, and has since been engaged in farming in Michigan.

Utah College and Station.—The Utah legislature adjourned March 22 after a session during which a determined effort to unite the college with the State university, either by consolidation on one site or by means of a joint board with separate maintenance, was unsuccessful. The appropriations for both the college and station were much reduced. For the next biennium \$90,000 was appropriated for the college, \$10,000 for investigations in dry farming, and \$5,000 for investigations in irrigation and drainage, in cooperation with this Office. Hon. W. S. McCornick, who has served as president of the board of trustees since the

organization of the college, has resigned. J. Q. Adams, of Logan, and Mrs. A. W. McCune, of Salt Lake, have been appointed on the board.

Vermont University and Station.—Hon. G. G. Benedict, a trustee for 42 years, and also secretary of the board, died April 8, aged 80 years. Joseph Battell, secretary of the American Morgan Breeders' Association, has deeded to the United States, for use in the cooperative work in horse breeding now being carried on by this Department and the station, a farm of approximately 300 acres near Middlebury, and about 35 miles south of the station. The farm is equipped with a large modern horse barn, and the cooperative work will be transferred from Burlington and its volume greatly augmented in the near future. C. G. Pringle, the veteran botanical collector, has been appointed to make a collection of solanaceous plants in Mexico for the station, in connection with the study of disease resistance. C. R. Pettis, State forester for New York, and in charge of the Adirondack forest seedling nurseries, has been appointed consulting forester to the station.

West Virginia University.—A summer school, beginning June 24 and closing August 3, is announced. Among the 25 courses of study offered are nature study, elementary agriculture, principles and methods of education, and school supervision.

Wisconsin University and Station.—H. L. Russell, professor of bacteriology in the university and bacteriologist to the station, has been appointed dean of the college of agriculture and director of the station, to succeed W. A. Henry at the beginning of the college year. Among other appointments and promotions announced are, as associate professor, D. H. Otis, in animal nutrition; as assistant professors, R. H. Denniston in botany, J. G. Moore in horticulture, and C. A. Ocock in agricultural engineering; as instructors, G. M. Reed in botany, James Milward in horticulture, and Conrad Hoffman in agricultural bacteriology; and as assistants, H. D. M. Jollivette in botany and Matthew Michels in butter and cheese scoring. In the announcement for the university summer school it is stated that Dean Henry will conduct a class in agriculture for teachers in the public schools.

The station is conducting a vigorous campaign against tuberculosis in the 100,000 dairy herds in the State. Existing laws provide for the inspection of cattle before entering the State, and a bill has been introduced into the legislature providing for the testing of all cattle before sale. Instruction in the use of the tuberculin test has been given to about 1,200 former agricultural students who compose the membership of the Wisconsin Agricultural Experiment Association. While under the laws regulating veterinary practice these students are not permitted to collect fees, they are nevertheless rendering much assistance.

Plan for County Experiment Stations.—A bill has been introduced into the Missouri legislature which authorizes any county court, on the petition of 50 freeholders or the resolution of any agricultural or horticultural society in the county, to establish and maintain an experiment station. This may be located at the county farm, or other land may be leased. Supervision is to be vested jointly in the county court and the State experiment station, and the work proposed is mainly that of demonstration.

A Mexican Botanical Station.—In a recent issue of *Plant World* an account is given of the botanical station and rubber laboratory recently established on La Zacualpa plantation, Chiapas, Mexico, under the direction of Dr. P. Olsson-Seffer. The larger part of the land is to be devoted to rubber, including experimental plats of Castilloa and a collection of all known rubber-producing plants, and the remainder will be used for the more unusual representatives

of Mexican flora and many foreign tropical plants. In conjunction with the station work experiments in hybridizing the coffee tree will be conducted on a neighboring plantation.

Agricultural College for Hawaii.—An act providing for the establishment of a college of agriculture and mechanic arts has been passed by the Territorial legislature of Hawaii and approved by the governor.

Credits in Agriculture at Columbia University.—Dean James E. Russell, of Teachers' College, announces that arrangements have been made to accept at full value for degrees in Columbia University work done in agriculture at any of the leading agricultural colleges. This is done with a view of fitting students for the position of director, principal, etc., in training schools for agricultural teachers.

Board of Food and Drug Inspection.—Dr. Frederick L. Dunlap, an instructor in the University of Michigan, has been appointed associate chemist in the Bureau of Chemistry, and will be a member of the board of food and drug inspection, which will consider all questions arising in the enforcement of the pure food law. The other members of this board are Dr. H. W. Wiley, chairman, and George P. McCabe, solicitor of the Department.

Plans for Irrigation Congress.—The Fifteenth National Irrigation Congress is to be held in Sacramento September 2–7. Its purpose is announced as being "to promote the development of wise and beneficial national irrigation and forestry policies, as well as to provide for discussions of practical details of irrigation and forestry." The plans include an interstate exposition of irrigated land products and forestry and a 1,000-mile excursion through the Sacramento Valley to enable delegates to study California farming and irrigation.

International Dairy Federation.—A detailed programme has been received for the third international congress of dairying, to be held, as previously announced, at The Hague September 16 to 20, 1907. The congress will be divided into sections of dairy legislation, hygiene, and industry. Its meetings will coincide with the national agricultural exhibition, which will include a subdivision devoted to the dairy industry, open to exhibits from all countries. Excursions have been arranged to the butter-control station and state dairy station at Leyden, the serotherapeutic institute at Rotterdam, the laboratory of bacteriology at Delft, and other points of interest. Additional information can be obtained from the secretary, Dr. A. J. Swaving, 88 Lange Voorhout, The Hague.

Institute of Agriculture at Rome.—According to a note in *Mark Lane Express*, the preliminary work for the organization of the National Institute of Agriculture at Rome, founded by King Victor Emmanuel, is proceeding actively. Great Britain, the United States, France, and other countries have promised their cooperation in the functions of the institute. A building is in course of erection and the first meeting of the general assembly is planned for 1909.

Department of Agriculture for Buenos Ayres.—Plans are under way for the establishment of a department of agriculture and animal husbandry in the Province of Buenos Ayres. A bill introduced into the local legislature provides for the establishment of such a department January 1, 1908, under the direction of the minister of public works, to consist of divisions of agriculture and animal husbandry. Six practical schools of agriculture and animal husbandry, which will also give instruction in forestry, are provided for, and an extensive inspection service. A commission of 5 members, one of whom must be an agricultural engineer and another a veterinary surgeon, is to be appointed by the president to determine the duties of the department, lay out a course

of study for the agricultural schools, and draw up regulations for the control of animal and plant diseases.

Investigation of Agricultural Instruction in Great Britain.—The president of the Board of Agriculture and Fisheries has, according to *Nature*, appointed a committee to inquire whether the provisions now made for scientific and technical instruction in agriculture in England and Wales are satisfactory and sufficient, and if not, in what manner they may with advantage be modified or extended. Prof. T. H. Middleton and Prof. W. Somerville are members of the committee.

Agricultural Students in German Universities.—*Chemiker Zeitung* states that the total number of matriculated students in the German universities is 44,942, of whom 985 or about 2 per cent are enrolled in agricultural science courses. Of these 573 or 58 per cent are from foreign countries, although the foreign students constitute but 9 per cent of the total enrollment.

Agricultural Education in Chile.—A practical school of agriculture was opened at Talca June 29, 1906, under the directorship of Carlos Echeverria Cazotte. The school was started with an appropriation of $71,000 for land and $28,000 for equipment and maintenance. The director is also professor of agriculture and zootechny, and is assisted by professors of forestry, physical and natural sciences, engineering, viticulture, and the common elementary branches. Twenty-four students were enrolled at the opening of the school.

Schools of Agriculture in Servia.—The consul at Belgrade, Servia, reports in the *Monthly Consular and Trade Reports* for February as follows:

"There are, in addition to the experimental farms at which instruction in agricultural subjects is given, three agricultural schools in Servia, as follows: (1) School of general agriculture at Kraljevo, (2) school of viticulture and arboriculture at Bukovo, and (3) school of agriculture at Sabac. Near Belgrade the government has a model farm, on which the best methods of farming are shown to the peasants and experiments are made as to the best grains, etc. In 1902 an experimental farm was established at Dorbricevo for the purpose of breeding animals. The government gave 1,000 hectares for this farm. After the almost total destruction of the vineyards by the phylloxera in 1882 the government established vineyards in order to restore this industry by experimenting. There were in 1905 six of these experimental vineyards. A considerable quantity of vines are given gratis to the cultivators, and those vineyards that resist the phylloxera are exempt from taxes for ten years."

At Smederevo (Semendria) there is also a dairy farm, established in 1903, which manufactures three grades of excellent cheese and offers special courses of instruction annually.

Agricultural Education Abroad.—According to the annual report of the Board of Agriculture and Fisheries, during the fiscal year 1906 the grants to agricultural education in Great Britain aggregated about $420,000. The number of students has increased from 23,000 to 34,000 in the last two years. A widening of public interest in the study of agriculture is reported, and it is stated that farmers are coming to rely more and more upon the agricultural institutions for assistance in the solution of their problems.

According to the *New Zealand Official Yearbook* for 1906, the Canterbury Agricultural College, at Lincoln, now has an endowment of 62,000 acres of land, which has a rental value of $7,290, and possesses extensive buildings and an experimental farm. The institution offers a good course in the science and practice of agriculture, which is accepted as a part of the curriculum leading to the degree of B. S. in agriculture at the University of New Zealand. The college accommodates 40 students. A report on the public schools for 1904 shows that 47 out of 725 schools gave instruction in elementary agriculture.

The *Wiener Landwirtschaftliche Zeitung* is authority for the statement that in 1905–6 there were 190 schools in Austria giving instruction in agriculture and forestry. This is an increase of 4 over the previous year, the new schools being the agricultural winter schools at Spittal-on-the-Drau, in Carnithia, and at Lubeza, in Galicia, the elementary forestry school at Klagenfurt, in Carnithia, and the farm school at Dignano, in Istria. The 190 institutions include 2 high school institutes, 3 agricultural academies, 9 agricultural high schools, 5 forestry high schools, 12 high schools for viticulture, pomology, and horticulture, 1 high school for the brewing industry, 41 farm schools or elementary agricultural schools with one-year courses, 73 agricultural winter schools, 10 elementary forestry schools, 16 dairy and housekeeping schools, 24 elementary special schools for horticulture, pomology, viticulture, hop culture, alpine farming, and apiculture, 2 brewing and 2 distillery schools.

The attendance at the royal agricultural high school at Vienna for 1905-6 was 668 for the first semester and 611 for the second semester. In the first semester 590 of the students were regular and 78 special. In the second semester 554 were regular and 57 special. About 48 per cent of all the students were enrolled in forestry courses.

A chair of agricultural-technological chemistry has been established at the polytechnic high school, Copenhagen, and Dr. Orla Jensen has been appointed to the position. The studies will be devoted principally to the utilization of milk and meat, and will include (1) the production and chemistry of milk, the bacteriology of milk, its uses for food, milk powder, casein, cream, butter, and cheese, and dairy associations, and (2) the production of meat and bacon, methods of pickling or salting, chemistry of pickling or salting, canned meat products, and the arrangement of slaughter houses for pigs.

The Queensland Agricultural College has been giving training courses in agriculture for teachers in State schools, and as a result some instruction in agriculture has been given in a number of schools. A movement has also been started to offer prizes for school gardens in the different districts of Queensland, and the Queensland department of agriculture has agreed to instruct its experts to visit country schools as far as practicable and give the pupils and teachers guidance and help.

The practical school of viticulture, established in 1893 at Praz sur Vevey, was discontinued in 1905 owing to the fact that the sons of the vine growers could not be spared during the busy season. In place of the regular school the Canton of Vaud has conducted successful short courses in arboriculture, viticulture, and the utilization of fruits. Such courses are announced for the autumn of 1907.

Y. M. C. A. Agricultural Clubs.—The educational department of the international committee of Young Men's Christian Associations has entered upon a campaign to encourage the associations in different parts of the country to start boys' agricultural clubs and boys' gardens as means of employing profitably the time of the younger members when pleasant weather out of doors attracts them away from the association rooms. A leaflet has been published giving suggestions for organizing the clubs and conducting the gardens.

Department of School Gardens.—The New York University, in its announcements for the summer school of 1907, includes an announcement for the department of school gardens under the direction of H. G. Parsons, who conducted successfully a similar department in 1906. It is proposed to combine lectures and laboratory work on soils, plants, and other technical matters relating to gardening, with a study of problems concerning the handling of children's gardens and the social features of such work.

Miscellaneous.—W. T. Horne has, according to a note in *Science*, been appointed head of the department of plant pathology in the Central Agricultural Experiment Station of Cuba.

Percival Maw has been appointed to the chair of forestry and estate management at the Royal Agricultural College, vice F. C. McClellan.

The *Wiener Landwirtschaftliche Zeitung* reports the death, on February 17, of Otto Kambersky, director of the Agricultural Experiment and Seed Control Station and of the agricultural winter school at Troppau.

A recent number of the *Deutsche Landwirtschaftliche Presse* notes the death, on March 17, of Dr. Rudolf Aderhold, director of the Imperial Biological Institute for Agriculture and Forestry at Dahlem.

La Semaine Agricole notes the death of Houdet, director of the national dairy school at Mamirolle, Doubs, since 1902, and states that he is succeeded by B. Kohler, at present departmental professor of agriculture in Doubs.

Cornell Countryman states that Modesto Quiroga, a recent graduate of Cornell and now professor of agronomy in the national university at Buenos Ayres, has been appointed inspector of agricultural schools in the Argentine Republic. Lupercio Fagundes, also a recent graduate, has been appointed vice-director of the experimental substation for rice investigations at Moreira Cezar, São Paulo, Brazil.

The section of agriculture and public works of the imperial ministry of Alsace-Lorraine has decided to establish on June 1, at Metz, a branch station of the experiment station at Kolmar. Dr. Hubert Rössler, assistant in the agricultural division of the Kali Syndicate, has been appointed director of the station.

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EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, Ph. D., *Assistant Director.*

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NOTE.—The publications of the United States Department of Agriculture, except those of the Weather Bureau, may be purchased from the Superintendent of Documents, Washington, D. C. For the publications of the Weather Bureau requests and remittances should be directed to the Chief of the Bureau. The price of the Record is $1 per volume, or 10 cents per number. The prices of other technical publications are given in the list above. The publications of the State experiment stations are distributed from the stations and not from the Department.

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EXPERIMENT STATION RECORD.

Vol. XVIII. June, 1907. No. 10.

The celebration of the semicentennial of the Michigan Agricultural College the week of May 26 was an occasion of national importance. It marked the anniversary of a significant and far-reaching departure in American education. While primarily the fiftieth anniversary of the establishment of the Michigan College, in a larger and more important sense it was the anniversary of a new type of education which has ripened into a great national system, fostered alike by the Federal and State governments, and already become one of the most potent influences in the educational world. It was the birthday of agricultural education—of an attempt to relate education more closely to the practical needs of life.

It was fitting that such an anniversary should be commemorated by the bringing together of men prominent in agricultural and industrial education and research from all over the Union, as well as the army of graduates and friends of the college. It was more than local, and such a representative gathering betokened the broad significance of the event celebrated. Its national character was further evidenced by the attendance of the President of the United States, the Secretary of Agriculture, and the Commissioner of Education, with inspiring addresses upon the influence and the mission of the land-grant colleges in the system of American education. It was a great day for the Michigan Agricultural College, but no less a day of triumph for agricultural education as a whole. The widespread public attention which it attracted placed the agricultural colleges in a new and more favorable light and assigned to them a more conspicuous place in the field of technical education.

Such an occasion, with its review of the history of this great movement, its lessons from the past, its survey of what has been accomplished in a material way and in the shaping of public sentiment, its forecast of the future with higher ideals and broader and more liberal plans for development, is stimulating and helpful to the land-grant colleges as a whole. It can not fail to give a larger conception of the mission and influence of these institutions and a clearer view of what education should be.

And for the pioneer institution it was an occasion for rejoicing and congratulation and for tribute to the success of its honorable career. Aside from delegates from colleges all over the Union, some twenty-five hundred of its sons and daughters gathered to do it honor, and the large meetings held in the tent provided for the occasion were live with enthusiasm and reminiscence and ardent in appeal for the preservation of old landmarks.

It is a notable achievement to have taken a leading part in "building new avenues along which knowledge is approaching more closely to human needs;" and to do this in the face of unbelief and dogmatic opposition has required a tenacious faith and an abiding courage. In planning and conducting this celebration of its anniversary, the Michigan Agricultural College has added to the debt of gratitude which all the colleges of the system owe to it, for it has shared with them the appreciation, the benefits, and the inspiration which arise from such a great national demonstration.

There was perhaps no more striking feature of the celebration than the recognition of the real significance attaching to the founding of this first agricultural college. In the light of fifty years of experience, the influences which have sprung from this initial step upon the educational conceptions of the whole country were weighed and meted out. It was naturally a day of reckoning, and while the various speakers did not withhold criticism of methods and standards and conceptions prevailing at various stages of development, they were generous in their praise of the final outcome. They paid high tribute to the educational significance of the movement.

President Wheeler, of the University of California, characterized the inauguration of the agricultural college as "a weird undertaking and audacious, unapproved of the elders," but he credited these colleges with having "embodied a fresh and vitally new idea of education and what it is all about." The mechanism of education had become largely a formal instrument of discipline. "The significance of the agricultural college," he said, "for the whole trend of American education was its naïve effrontery in frankly seeking for life training a new connection with real life use; and this significance exceeds in service to the nation even the weight of the benefits wrought for the tilling and the tiller of the soil"—a statement so broad in its character that from a less reliable or a partisan source it might be regarded as a possible exaggeration.

Secretary Wilson described the establishment of the agricultural college as one of the significant and far-reaching events of the nineteenth century. In these institutions the foundation of agricultural education and research have been laid "to prepare the farmer for his life work, provide agricultural literature, and lift the tiller of

the soil to a higher level of efficiency as a producer and a citizen." He declared that these colleges have broadened the minds and strengthened the arms of the farmers, helped them into a class by themselves among tillers of the soil, and dignified their calling.

Commissioner Brown, of the Bureau of Education, expressed his high appreciation of the land-grant colleges and emphasized their importance in the general educational system of the country.

Similar utterances by other speakers assigned to the agricultural college a high place among the influences which have been active in developing technical education; and Doctor Jordan said: "It is generally conceded that no instance is on record where technical knowledge has been brought into such close and practical touch with the people as has been done for our agriculture during the past twenty-five years."

The boldness and novelty of the undertaking become more apparent when the conditions of the times are remembered. In 1850 Michigan was in things cultural still the frontier—a pioneer country. Its population had not yet reached 300,000, less than the present population of a single city within its borders; and its farms numbered 34,000, embracing only about 4,000,000 of its 37,000,000 acres.

At that time the public school system of the country was but feebly developed, and the responsibility of the States for education was only recognized to a quite limited extent. The teaching of natural science in the higher institutions was quite restricted, and opposition to its introduction had hardly begun to be overcome. Technical schools for other branches were almost unheard of, and manual training as a branch of the educational system had not begun to receive consideration. Without the example of a successful agricultural college in America, and without the prestige of precedent as an argument for such action, the constitution adopted in 1850 committed the State to the policy of establishing and maintaining an agricultural college where the natural sciences in relation to agriculture should be taught. And five years later the State appropriated $56,000, a large sum for that time, to carry this provision into effect.

The question naturally arises as to the source from which the inspiration came for this action, the influences which had been working, and what supplied the courage and conviction essential to such an unprecedented step. There seems to have been a prevalent idea even at an early day that science was to be of great aid and value to the fundamental industry of agriculture. There had been considerable agitation of agricultural instruction and agricultural schools in the East, and the experience of Germany had been given considerable publicity in this country. There were many who believed in agricultural instruction, and it appealed to the public generally as being a practical form of education whose benefits could be readily appre-

ciated. But even so, the taking of so important and novel a step by this frontier State was a bold and radical departure from the traditions of education.

The State Agricultural Society was organized in 1849, and, as agriculture was the great industry of the State, the society had the support and cooperation of the leading men, as well as of the farmers themselves. Secretary Butterfield, in describing the influences that have made the college what it is, credited the Agricultural Society with having been a very potent influence in this direction, and with having secured funds for the establishment of the college in 1855, after repeated appeals to the legislature. Two years later, in May, 1857, the college opened its doors to students.

The anniversary exercises brought out much of interest regarding the early history of the college, which showed how humble and crude were its beginnings and how great the obstacles against which it had to contend. One session was given up to the "builders of the college," with addresses upon the men and the conditions of the early days. The conditions surrounding the new institution are well illustrated by a statement from the address of President Monroe, of the State board of agriculture, who spoke for the college and the students of '57 to '60. "The college was a typical Michigan pioneer," he said, "in starting in the woods, in opening up roads, in logging and burning green timber—much of it in the wet season of the year—the pulling of green stumps and digging where an ax was as important as the spade or the shovel." The transformation in the college and its surroundings which fifty years have wrought is typical of the progress and upbuilding of agricultural education which have taken place in that period.

From the nature of the occasion, interest centered largely around matters historical, both at the anniversary celebration and the convention of the Association of American Agricultural Colleges and Experiment Stations, which was held in connection with it. The exercises took on a historical cast and there was much discussion along the lines of the unwritten history of agricultural education and research in this country, the agencies and influences that have been operative at different stages of development, and the sources from which the leaders drew their inspiration.

These discussions served to show how little systematic study has been given to the movement for these land-grant institutions in connection with the condition of the times, the influences and tendencies then in evidence, and the individual efforts of prominent exponents working in different parts of the country. The question was even raised as to the causes which first led Mr. Morrill to propose national legislation, for the opinion seemed prevalent that the ideas embodied in the measure which he so persistently and untiringly pressed

through several sessions to final passage were not entirely original with him. It developed that several men in different parts of the country were agitating the establishment of such institutions and that Mr. Morrill was in touch with some of them.

These historical matters developed a somewhat unexpected amount of interest and a desire for thorough and systematic study upon the early history of agricultural education in this country. The discussion opened the way for a line of inquiry that would be most interesting.

The development of the pedagogy of agriculture was likewise an interesting topic of discussion, which was started at the meeting of the Society for the Promotion of Agricultural Science with a paper by Dr. A. C. True. As indicating how slowly the teaching of this new subject worked out, it was mentioned that as recently as 1895, when a standing committee on methods of teaching agriculture was organized by the association, the agricultural departments of the colleges were relatively weak and ill organized and were not taking due advantage of the rapidly accumulating pedagogical material afforded by the experiment stations. The first report of this committee in 1896 pointed out that "there exists at present in this country no standard for instruction in agriculture. There is a bewildering variety as regards the topics taught, the time devoted to each topic, the order in which the different topics occur in the course, the relative amount of class-room work and laboratory or practical exercises, etc. Granting all that ought to be conceded because of local conditions, it is nevertheless obvious that general progress in the teaching of agriculture in college courses can hardly be expected until there is greater uniformity in planning and conducting the courses of study in this subject."

Not until the nineties did it begin to be understood by college presidents and trustees that the old policy of waiting to establish adequate agricultural courses until multitudes of students were clamoring for them was wrong. Experience soon demonstrated that when the agricultural courses were made respectable as regards faculty and equipment, a reasonable number of students would take them.

The passage of student labor as a part of the agricultural course, one of the early traditions of the agricultural colleges, was a fruitful subject of reminiscence among earlier students, and was generally looked upon as having failed to accomplish its purpose owing to failure to conceive the real pedagogic purpose and method. "Nobody seemed able to devise a good system of educational labor, and the whole scheme of student labor as a part of a college course in agriculture fell into discredit and disuse."

Another important transition which has come as the result of accumulated experience is the size of the teaching force considered

necessary for the strictly agricultural subjects. In comparison with the old-time professor of agriculture who covered the whole range of agriculture and frequently had other duties as well, the present differentiation stands out in strong contrast, making for increased specialization and efficiency. In many cases much of the field now occupied by agricultural instructors was formerly covered by the teachers of the primary sciences, often resulting in a divorce of science and practice. The natural consequence was that the instruction in agriculture was often given over to practical men without much scientific training. There was comparatively little attention given to the building up of agricultural courses on a sound pedagogic basis; and agriculture as a subject of college instruction fell into more or less contempt among educators and students.

In most of the colleges the agricultural faculty is increasing rapidly, and the old-time professor of agriculture has become as much of an anomaly at the present day as a professor of natural science would be in a college of science.

As showing the change in material equipment and facilities for instruction, an appeal was read from Prof. Levi Stockbridge's report for 1873 for "a lecture room, suitably furnished with appropriate emblems and diagrams, and adjoining cabinet and museum rooms supplied with everything needed to make the instruction of the professor of agriculture as interesting and useful as possible." Such an appeal seems to-day almost pathetic. The special building for agriculture has become almost a commonplace and an accepted necessity at the agricultural college, with laboratories of various kinds and rooms for every description of indoor work. Incidentally it was mentioned that the new agricultural building at Cornell contains 47 rooms for dairying alone.

Along with these changes in methods of teaching, development of the teaching force, and the like, has come as a lesson of the past a higher and broader conception of the mission of these colleges and the functions of education. This has been an important development, and one to which attention was naturally called on such an occasion.

President Roosevelt in his address, in speaking of the mission and the limitations of these institutions, laid down the broad principle that "no industrial school can turn out a finished journeyman, but it can furnish the material out of which a finished journeyman can be made." This is an important and pertinent statement, which applies with special force to the agricultural college. Their attempt to turn out finished farmers has led them into error in planning their courses, affected their educational ideals, and brought upon them criticism as severe as did their early failure to accomplish that end.

It has been an unreasonable and unwise expectation that the agricultural colleges would turn out finished farmers, equipped at the same time with an education such as the world expects of a college man. The attempt to meet this popular expectation has impoverished their courses in elements which develop the many-sided man, and tended to make them simply training schools for technicians. This does not meet the present idea of education, technical or otherwise. As one speaker put it, "intensive knowledge of one subject does not compensate for extensive ignorance of everything else. A man's intellectual and social well-being must not be wholly subordinated to his vocational skill."

This broader conception of agricultural education was voiced by the President in the statement that these colleges "seek to provide for the people on the farms an equipment so broad and thorough as to fit them for the highest requirements of our citizenship, so that they can establish and maintain country homes of the best type and create and sustain a country civilization more than equal to that of the city. . . . The education to be obtained in these colleges should create as intimate relationship as possible between the theory of learning and the facts of actual life. . . . The ordinary graduate of our colleges should be and must be primarily a man and not a scholar."

And again he said: "We shall never get the right idea of education until we definitely understand that a man may be well trained in book learning and yet, in the proper sense of the word and in all practical purposes, be utterly uneducated; while a man of comparatively little book learning may nevertheless in essentials have a good education."

President Wheeler voiced this sentiment forcefully in his statement that "education inheres not in what you put into a man or what you hang onto a man, nor yet in sterilizing him or shaving him down to a standard shape; but in giving him, such as he is and such as his life activities may be, the opportunity in and through those activities of living his life fully and effectively and abundantly. Such education will therefore address itself perforce to the real doings and exercises of real life, and its definition will be: The guided practice of life, to the end that men may live."

Opposition to the college graduate in agriculture has very largely disappeared. He finds a ready market for the special qualifications which his education has given him. It is now recognized that if the college is not turning out finished farmers in the strictly practical sense, its courses are furnishing the material out of which finished farmers of superior type are made; that agricultural education must be intellectual and must deal with facts and principles rather

than with things alone. Such education not only rescues men from the rule of thumb, but equips them to use knowledge in a more discriminating way, trains them as men, and prepares them for leadership in the community.

The latter is a most important qualification, for, as the President said, "No farmer's life should lie merely within the boundary of his farm." Under present conditions the problem of the farm is much more than the growing of wheat and corn and cattle. To quote again from the President: "The problem of production has not ceased to be fundamental, but it is no longer final; just as learning to read and write and cipher are fundamental, but are no longer the final ends of education. We hope ultimately to double the average yield of wheat and corn per acre; it will be a great achievement; but it is even more important to double the desirability, comfort, and standing of the farmer's life. . . . We must try to raise the average of farm life, and we must also try to develop it so that it shall offer exceptional chances for exceptional men."

The agricultural college, with its experiment station and other agencies, is looked to as the leader in the movement for the improvement not only of agriculture as an industry, but the farmer as well and the social conditions of his environment. From it must come the men and the impulse and the plans for the "redirection of rural institutions," a subject ably discussed in Dean Bailey's presidential address upon The State and the Farmer.

Such broad conceptions of the field and mission of the land-grant colleges make them seem more truly educational and bring them closer yet to the problems of real life. They give us something toward which to work and a field which is most inspiring. They stand in strong contrast to the tendency to eliminate all lines of study which do not bear a direct and intimate relation to the production of wealth from the soil. They point to the fact that "the only way to uplift any industry is to develop among those who are engaged in it not only technical knowledge and skill, but intellectual and moral force."

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

Nitrogen availabilities by modifications of the alkaline permanganate method, S. M. Herrick (*Virginia Sta. Rpt. 1906, pp. 27–30*).—Tests of the official alkaline permanganate method and various modifications of it on sodium nitrate, dried blood, horn meal, hoof meal, bone meal, tankage, cotton-seed meal, raw leather, and peat are reported, from which it is concluded that the following modification of the method gives most satisfactory results: "Weigh out an amount of the sample containing 0.045 gm. of nitrogen and transfer to a 1,500 cc. thick-walled distilling flask. After connecting with a condenser to which a receiver containing a standard acid has been attached, digest with a mixture of 400 cc. of ammonia-free water and 100 cc. of alkaline permanganate solution (16 gm. of potassium permanganate and 150 gm. of sodium hydrate dissolved in water and made to the bulk of one liter) till 150 cc. is distilled."

The determination of phosphoric acid in form of ammonium phosphomolybdate, H. Pellet (*Bul. Assoc. Chim. Sucr. et Distill., 24 (1906), pp. 525–528; abs. in Chem. Zentbl., 1907, I, No. 7, p. 505*).—The author refers to the investigations of Graftiau on this subject as confirming the results of previous work by himself, and explains the details of his method.

Phosphotungstic acid as a reagent for potassium, G. C. Meyer (*Chem. Ztg., 31 (1907), No. 13, pp. 158, 159*).—Experiments are reported to show that phosphotungstic acid possesses much the same properties as a reagent for potassium as phosphomolybdic acid. Using a 20 per cent solution of sodium phosphotungstate about as accurate results were obtained, especially with high percentage solutions of potash salts, as with the platinum chlorid. The method is asserted to be cheap and convenient and especially adapted to industrial work.

On the determination of the calcium carbonate content of marls, M. J. Van't Kruijs (*Chem. Weekbl., 4 (1907), pp. 29–32; abs. in Chem. Zentbl., 1907, I, No. 10, pp. 756, 757*).—The author reports that good results can be obtained by the use of acetic acid to set the carbon dioxid free if the fresh soil is first ground with successive small portions of water.

Recommendations as to the nomenclature of the proteins (*Proc. Chem. Soc. London, 23 (1907), No. 321, pp. 53–67*).—A joint committee of the Physiological Society and the London Chemical Society has recommended a classification of the nitrogenous constituents of animal and vegetable products. "The word protein is recommended as the general name of the whole group of substances under consideration." "The word proteid, which is used in different senses in this country and in Germany, should be abolished. . . . If used at all, the term albuminoid should be regarded as a synonym of protein."

Protein is divided into protamins, such as salmin and sturin; histones, like those separated from blood corpuscles; albumins, such as egg albumin and

serum albumin; globulins, such as serum globulin and fibrinogen; sclero-proteins, such as gelatin, keratin, etc.; phospho-proteins, such as vitellin, caseinogen, and casein; conjugated proteins, and derivatives of proteins.

Conjugated proteins are substances in which the protein molecule is united to a prosthetic group, the principal subdivisions being nucleo-proteins, gluco-proteins (mucin), and chromo-proteins (hemoglobin). The derivatives of protein include meta-proteins (acid-albumin, alkali-albumin), proteoses (albumose, globulose, gelatose, etc.), peptones, and polypeptids.

As regards peptones, "this term should be restricted to the further products of hydrolysis which differ from the proteoses inasmuch as they can not be salted out from solution and usually resemble them in giving the biuret test. It has been pointed out that certain vegetable products hitherto regarded as peptones do not give the biuret test. It does not appear possible to bring such exceptional substances into any general classification at present. The same difficulty in classifying arises in connection with certain other vegetable proteins—for instance, those which, like gliadin, are soluble in alcohol."

"The term caseinogen should be used for the principal protein in milk and casein for its derivative, which is the result of the action of rennet.

"The two principal proteins of the muscle plasma should be termed paramyosinogen and myosinogen; the term soluble myosin should take the place of von Fürth's soluble myogen-fibrin; the term myosin should be restricted to the final product formed during *rigor mortis*."

The chemistry of the protein bodies of the wheat kernel. II, Preparation of the proteins in quantity for hydrolysis, T. B. OSBORNE and I. F. HARRIS (*Amer. Jour. Physiol., 17 (1906), No. 3, pp. 223–230*).—Continuing earlier work (E. S. R., 16, p. 846), the authors prepared in quantity specific proteids of wheat which they had isolated, namely, globulin, gliadin, and glutenin. The amounts of globulin obtained were not sufficient for extended study, and no attempt was made to prepare the proteoses for further investigation, "as we have no means of determining the origin of these proteoses or of separating the mixture into products of probable chemical individuality."

As shown by an average of 25 analyses wheat gliadin contained 52.72 per cent carbon, 6.86 per cent hydrogen, 17.66 per cent nitrogen, 1.14 per cent sulphur, and 21.62 per cent oxygen. Leucosin and glutenin had practically the same elementary composition as wheat gliadin, as did also the gliadin of rye. The authors believe, however, that glutenin and gliadin are distinct bodies.

The chemistry of the protein bodies of the wheat kernel. III, Hydrolysis of the wheat proteins, T. B. OSBORNE and S. H. CLAPP (*Amer. Jour. Physiol., 17 (1906), No. 3, pp. 231–265*).—Studies of the cleavage products of the specific proteids of wheat are reported from which the authors conclude that gliadin, glutenin, and leucosin are separate and distinct bodies. Gliadin is free from glycocoll, the 0.02 per cent found in one case being regarded as due to the presence of a trace of glutenin. Leucosin is similar in its composition to animal proteids, which perhaps has a bearing upon its occurrence in the wheat embryo in distinction to gliadin and glutenin, which are typical reserve proteids. Reference to earlier work is given above.

Studies on the true nature of gluco-proteins and leucins, L. HUGOUNENQ and A. MOREL (*Bul. Soc. Chim. France, 4. ser., 1 (1907), No. 4, pp. 154–165*).—Studies of the cleavage products showed that so-called leucins and gluco-proteins are mixtures of amido acids.

On the increase in weight in the hydrolysis of casein, J. H. LONG (*Jour. Amer. Chem. Soc., 29 (1907), No. 3, pp. 295–299*).—The author investigated

the amount of water and hydrochloric acid absorbed by casein during artificial peptic digestion. The increase in weight was divided irregularly between the water and hydrochloric acid.

On the hydrolytic cleavage products of caseoplasteins, L. ROSENFELD (*Beitr. Chem. Physiol. u. Path., 9 (1907), No. 5–7, pp. 215–231*).—So-called plasteins were prepared from casein by digesting the casein with pepsin and hydrochloric acid, neutralizing with sodium hydroxid, evaporating until the content of solids was about 30 per cent, acidifying with hydrochloric acid, and adding rennet, the resulting precipitate being designated plastein. The properties of 5 preparations of this kind were studied in comparison with casein. The plasteins showed a higher percentage of carbon and a lower percentage of nitrogen. The following cleavage products were obtained from the plasteins: Arginin, histidin, lysin, tyrosin, leucin, α-pyrrolidin carbonic acid, phenylalanin, and glutaminic acid. As compared with casein the plastein showed a much lower percentage of amids.

Disadvantages of potassium bichromate for the preservation of milk samples for analytical purposes, P. GRÉLOT (*Jour. Pharm. et Chim., 6. ser., 25 (1907), No. 8, pp. 369–373*).—Various objections to the use of potassium bichromate are discussed. The most serious of these, according to the author, is the fact that potassium bichromate even in the proportion of 2:1,000 and without the addition of sulphuric acid produces in milk a substance giving the general reactions of aldehydes, which may easily lead to an error as regards the use of formaldehyde as a preservative.

The chemistry of Hehner's test for formaldehyde in milk, O. ROSENHEIM (*Analyst, 32 (1907), No. 373, pp. 106–108*).—Pure sulphuric acid and pure formaldehyde give no color reaction with proteins. A color is, however, obtained after the addition of small amounts of oxidizing substances. The author does not believe that this color is due to the interaction of the oxidation products of protein with formaldehyde. He obtained evidence, however, to show that the formaldehyde may first be oxidized, giving rise to an intermediate oxidation product which reacts with the protein, and also that the formaldehyde may first combine with the protein forming an aldehyde protein compound which subsequently becomes oxidized. The formaldehyde reaction, which is a general one for proteins, depends upon the presence of the tryptophane group in the protein molecule.

The cherry-red coloration of milk in the presence of concentrated alkalis, C. GAUTIER, A. MOREL, and O. MONOD (*Compt. Rend. Soc. Biol. [Paris], 62 (1907), No. 11, pp. 542, 543*).—Tests are reported to show that the red color produced in milk by the addition of one-fifth its volume of 40 per cent potassium or sodium hydroxid is due solely to the simultaneous presence of a proteid and a carbohydrate, which is contrary to the view recently expressed by Krüger (E. S. R., 18, p. 810). The reaction of glycocoll with lactose and maltose was so marked that the authors believe that glycocoll may be used for the detection of these two sugars.

A comparison and criticism of the methods for the detection and estimation of cocoanut oil in butter, T. R. HODGSON (*Chem. News, 95 (1907), No. 2468, pp. 121, 122*).—The author concludes that "the saponification number is of no practical value, either qualitatively or quantitatively. The Reichert-Wollny number may show some indication of the presence of cocoanut oil if the amount present in the sample is large. Wijsmann and Reijst's method [E. S. R., 17, p. 834] is by far the best qualitative experiment, since it shows a difference between the 2 silver numbers in the presence of even as little as 5

per cent of cocoanut oil, but as a quantitative method it is of no value. Thorpe's method is an excellent confirmatory test, as is also the extraction of phytosterol. The only exact quantitative method is the iodin absorption."

Experiments on the determination of the molecular weight of oils and fats, W. NORMANN (*Chem. Ztg., 31 (1907), No. 17, pp. 211–214, dgms. 8*).—A method and apparatus for determining the molecular weight of oils and fats are described and analytical data reported.

The detection of cane sugar in milk and cream, W. H. ANDERSON (*Analyst, 32 (1907), No. 372, pp. 87, 88*).—The author finds that the Cayaux resorcin test is rapid and reliable. It consists in adding 0.1 gm. of resorcin and 1 cc. of strong hydrochloric acid to 15 cc. of milk and heating the mixture to the boiling point. In the presence of cane sugar a red color is produced.

Concerning starch, W. H. BLOEMENDAL (*Pharm. Weekbl., 43 (1906), pp. 1249–1265; abs. in Chem. Zentbl., 1907, I, No. 3, pp. 176, 177*).—The chemical composition and heat of combustion of potato starch, rice starch, wheat starch, and maranta starch are reported. According to the author, starches consist principally of β-amylose, the proportion of α-amylose varying from 8.3 to 17 per cent. Amylodextrin, as well as other hydrolysis products, is also present.

Polarimetric determination of sugar in honey, P. LEHMANN and H. STADLINGER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 7, pp. 379–419*).—A critical study of analytical methods.

The influence of basic lead acetate on the rotation of sucrose in water solution, F. BATES and J. C. BLAKE (*Jour. Amer. Chem. Soc., 29 (1907), No. 3, pp. 286–293, chart 1*).—The investigations reported show that the amount of basic lead acetate solution used in clarifying sugar solution for polarization affects the reading. This is attributed to the formation of soluble lead saccharates having specific rotations different from that of sugar. The reading was lowered by quantities of the lead solution less than 6 cc. and increased by larger amounts.

The use of polarized light in the detection, by means of a microscope, of rice and cornstarch in wheat flour, G. GASTINE (*Ann. Chim. Analyt., 12 (1907), No. 3, pp. 85–87*).—According to the author, the microscopical methods outlined, which included the use of polarized light, gave very satisfactory results.

The detection of rice husks in bran, E. KINKELS (*Ann. Chim. Analyt., 12 (1907), No. 3, pp. 92, 93*).—A note on the colorimetric identification of rice bran by means of dimethyl-paraphenylene-diamin.

A new method of determining hyposulphites in food in the presence of sulphites, A. GUTMANN (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 5, pp. 261–265*).—The method described depends upon the fact that potassium cyanid acted upon by thiosulphate forms potassium sulphocyanite, which gives a blood-red coloration of iron sulphocyanite on the addition of acidulated iron-chlorid solution.

Report on methods of beer analysis, H. E. BARNARD (*U. S. Dept. Agr., Bur. Chem. Circ. 33, pp. 16*).—This is a full report of the associate referee on beer presented at the last convention of the Association of Official Agricultural Chemists (E. S. R., 18, p. 397). The methods which are given in this report and which are now before the association for adoption as official were based upon considerable cooperative work by 10 chemists.

The use of carbon bisulphid in the estimation of salicylic acid in wine, W. L. DUBOIS (*Jour. Amer. Chem. Soc., 29 (1907), No. 3, pp. 293, 294*).—The dried ether extract from 100 cc. of wine is treated with ten 5 cc. portions of carbon bisulphid and the salicylic acid determined colorimetrically in this

solution. This method eliminates the tannin and coloring matters which interfere with the color reaction when ether alone is used as a solvent.

Mineral acids in vinegar, F. D. RATCLIFF (*Analyst, 32 (1907), No. 372, pp. 82–84*).—The author reports a comparison of methods for detecting mineral acids in vinegar and points out that results may be too high or too low, according to the method followed. In his judgment, commercial vinegar is no longer adulterated with mineral acids, so that the elaboration of methods for their detection is not necessary.

Progress made during 1906 in the examination of foods and condiments, UTZ (*Österr. Chem. Ztg., 10 (1907), No. 6, pp. 72–79*).—The data summarized have to do with the examination of water, milk, wine, fats and oils, flour, meat and meat goods, preservatives, condiments, etc.

Miscellaneous chemical analyses made in 1903, 1904, and 1905, A. M. PETER ET AL. (*Kentucky Sta. Rpts. 1903, pp. 265–311; 1904, pp. 173–194; 1905, pp. 225–236*).—These three reports contain analyses of 35 samples of sorghum, 48 of sugar beets, 15 of soil, 1 of marl, 5 of oats, 2 of horse weed (*Ambrosia trifida*), 1 of alfalfa, 1 of red clover, 3 of corn stover, 11 of commercial feeding stuffs, 19 of tobacco, 1 of distillery slop, 1 of corn, 8 of butter, 1 of wood ashes, 1 of sal Bordeaux, 3 of petroleum, 3 of forage plants, and 109 of mineral waters.

Examination of papers, F. P. VEITCH (*U. S. Dept. Agr., Bur. Chem. Circ. 34, pp. 10*).—This circular gives the "methods and tests by which the composition and value of paper are judged, examples illustrative of the nature and interpretation of results, and brief outlines of the characteristics which the more important classes of paper should possess."

METEOROLOGY—WATER.

Climate of Virginia, G. T. SURFACE (*Bul. Amer. Geogr. Soc., 39 (1907), No. 2, pp. 92–98*).—Data for mean annual temperature, rainfall and snowfall, and length of growing season at 10 representative stations in Virginia from 1900 to 1905 are tabulated, and the climatic conditions of the different physical divisions of the State are discussed. It is shown that the climatic belts are in general coincident with the physical divisions of the State, namely, Tidewater, Middle Virginia, Piedmont, Blue Ridge, Valley, and Appalachia.

The mean annual temperature of Tidewater is 58 to 61° F., the rainfall 35 to 45 in., and the average growing season 7 to 7½ months. The mean annual temperature of the extreme southern Tidewater region is about 60°, and in this belt cotton is grown to a limited extent. The soil of the region is universally sandy or a sandy loam, which with adequate rainfall and a warm temperature is well adapted to truck farming.

The average mean annual temperature of the Middle and Piedmont regions is 56 to 58°. The growing season is 2 to 3 weeks shorter than in Tidewater. This region is especially adapted to tobacco culture.

The Blue Ridge, Valley, and Appalachia regions constitute the mountain district of the State. The mean annual temperature of Blue Ridge and the Valley is 52 to 56°, and of Appalachia 48 to 54°. The area covered by these regions is especially suited to grasses, grains, and apples. The length of the growing season is 5½ to 6 months in Blue Ridge and the Valley, and about 2 weeks less in Appalachia. This region, together with a part of Piedmont adjacent to Blue Ridge, is peculiarly adapted to apple culture.

The rainfall throughout the State is, as a rule, abundant and well distributed. "There is a wide variation in the snowfall of the State, both regionally and

seasonally. It is usually light and of short duration in Tidewater and Middle Virginia. From the Blue Ridge westward, however, it is not uncommon for the ground to be blanketed for a period of 6 weeks or 2 months. This is of great economic value to the grain and grass crops of the region, protecting them not only against the intense cold of January and February, but ameliorating the effect of the thaws of occasional warm days. . . .

"The climate of Virginia is ideally adapted to successful agriculture, since the prevailing conditions in the different geographic divisions are such as are best suited to the soils of those regions. . . .

"The rainfall has the most advantageous monthly distribution with reference to farming operations and the growth of crops, being somewhat heavier from April to July, which makes disastrous droughts unknown. The growing season of each section is always long enough to mature the standard crops of that section."

[Meteorological observations, 1906], H. L. Price (*Virginia Sta. Rpt. 1906, pp. 36–38*).—A monthly summary of observations on temperature, precipitation, wind movement, and cloudiness is given with a comparison of monthly temperatures and precipitation for 14 years.

Meteorological summaries for the years 1903, 1904, and 1905 (*Kentucky Sta. Rpts. 1903, pp. 312–317; 1904, pp. 195–198; 1905, pp. 237–242*).—Tabular summaries are given of observations at the station on pressure, temperature, precipitation, cloudiness, wind movement, and casual phenomena.

Meteorological observations (*Nature [London], 75 (1907), No. 1949, pp. 448–450, fig. 1*).—This is a review of a number of articles which have recently appeared in meteorological journals on the following subjects: Sunshine and snowfall in 1906 in the British Isles, rainfall of Scotland in May, 1906, the atmosphere in the Tropics, meteorological observations on the summit of the Tsukubasan, Japan, meteorology of India, meteorological observations in Cape Colony, forty years of southern New Mexico climate (E. S. R., 18, p. 611), and meteorological observations in Germany by the Deutzche Seewarte, Hamburg, 1905.

Meteorological observations at Montpellier (*Ann. École Nat. Agr. Montpellier, n. ser., 6 (1907), No. 4, app.*).—A diagrammatic record is given of observations at the observatory of the National School of Agriculture on temperature of the air and of the soil, pressure, humidity, rainfall, cloudiness, evaporation, and direction and force of the wind during June to November, 1906.

Distribution of rainfall during the year 1906, H. A. Hunt (*Agr. Gaz. N. S. Wales, 18 (1907), No. 2, pp. 174–177*).—The rainfall conditions of New South Wales during each month of the year are briefly described. The year as a whole was characterized by deficient rainfalls, 20 to 30 per cent below normal, for the coastal and mountain districts, and excessive rainfalls, 50 to nearly 100 per cent above normal, for other districts.

Experiments on hail shooting at Castelfranco, Venice, during the years 1902 to 1906 (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 15 (1906), II, No. 2, pp. 680–682; abs. in Ciel et Terre, 27 (1907), No. 22, pp. 591, 592; Science, n. ser., 25 (1907), No. 637, p. 434*).—This is the report of a commission appointed by the Italian minister of agriculture to make experiments to determine the efficiency of the method of using explosives to dissipate hailstorms. Absolutely negative results were obtained during the five-year period of experiment, and the commission concludes that there is no hope of preventing damage by hail by means of so-called hail shooting, and that protection must be sought along wholly different lines.

After the freeze, P. J. Wester (*Fla. Agr., 34 (1907), No. 4, p. 1*).—The character and results of the Florida freeze of December 26, 1906, are briefly described and means of protection against such freezes are suggested.

The Müller self-registering anemometer (*Ann. Dir. Hydraul. et Amélior. Agr., Min. Agr. [France], 1906, No. 31, pp. 305, 306*).—The construction of this instrument is briefly described.

On the occurrence of nitro-bacteria in the sea, P. THOMSEN (*Ber. Deut. Bot. Gesell., 25 (1907), No. 1, pp. 16–22*).—Such organisms were found in the ooze from the Bay of Naples, the harbor of Kiel, and the roadstead of Helgoland, as well as in the surface waters.

On nitrogen-fixing bacteria from the Bay of Naples, W. BENECKE (*Ber. Deut. Bot. Gesell., 25 (1907), No. 1, pp. 1–7*).—The occurrences of Azotobacter vegetation was established contrary to the contention of Nathansohn.

Underground water supplies from a sanitary point of view, B. LATHAM (*Surveyor, 31 (1907), No. 792, pp. 382–384*).—This paper discusses the origin and quantity of underground waters, the sources of impurity, the effects of pumping, and the relation between typhoid fever and the water line, especially as affecting the water supply of London and other English cities.

[Municipal engineering in 1906 in relation to water supply and sewerage and sewage disposal] (*Surveyor, 31 (1907), No. 784, pp. 80–83, 85–91*).—These subjects are discussed in a general review of progress in municipal engineering during the year, particularly in Great Britain, but also in other countries.

SOILS—FERTILIZERS.

Report on statements of Dr. Cyril G. Hopkins relative to Bureau of Soils, W. M. HAYS and M. WHITNEY (*U. S. Dept. Agr., Office Sec. Circ. 22, pp. 12*).—This circular contains replies by the Assistant Secretary of Agriculture and the Chief of the Bureau of Soils of this Department to statements made by Prof. C. G. Hopkins, of the University of Illinois, in an open letter of March 26, 1906, and in an address as president of the Association of Official Agricultural Chemists, published as Circular 105 of the Illinois Experiment Station (E. S. R., 18, p. 607).

Transformation of volcanic rocks into aluminium phosphate under the influence of substances of physiological origin, A. LACROIX (*Compt. Rend. Acad. Sci. [Paris], 143 (1906), pp. 661–664; abs. in Jour. Soc. Chem. Indus., 25 (1906), No. 23, p. 1145*).—This article describes the large deposits of aluminium phosphate found on the Island of St. Thomas and on other islands in the Gulf of Guinea, which, it is asserted, are the result of the reaction of the excrement of sea fowl on the trachytes and other volcanic rocks of the island. Apparently such decomposition of siliceous rocks has not been before observed. The alkalis of the rocks have not been retained as phosphate, probably having been washed out by the copious rains to which the islands are subject.

A contribution to the study of the alkaline rocks of East Africa, H. ARSANDAUX (*Compt. Rend. Sci. Mission Duchesne-Fournet [Paris], 1906, pp. 96, pls. 9; abs. in Amer. Jour. Sci., 4. ser., 23 (1907), No. 135, pp. 230, 231*).—The author reports petrographical and chemical examinations of extrusive igneous rocks which cover large areas in French Somaliland in the southern part of the Afar region of East Africa. It is shown that "these rocks are of acid alkalic character and of three prominent types, rhyolites with ægirite and riebeckite or comendites, pantellarites with ægirite-augite and cossyrite and trachytes." The results are of interest as indicating the wide distribution in volcanic regions of highly alkalic rocks in which soda predominates.

On the formation of hardpan, T. MARR (*Meded. Proefstat. Oost-Java, 4. ser., 1907, No. 30, pp. 145–167*).—The formation and character of a peculiar hard layer known as "padas," which widely occurs in Java soils, are discussed.

Is there any considerable evaporation of ammonia from soils? LILIENTHAL (*Illus. Landw. Ztg., 26 (1906), No. 99, pp. 851, 852; abs. in Chem. Ztg., 31 (1907), No. 9, Repert. No. 7, p. 42*).—Summarizing the results of 6 years' experiments on soils rich in lime, the author finds that on such soils ammoniacal nitrogen not only gives as good results as nitrate nitrogen, but in some cases better results.

In recent experiments with barley on light sandy soils the efficiency of the ammoniacal nitrogen was from 97.6 to 98.5 per cent of that of the nitrate nitrogen. These results were obtained on soil which had been heavily limed. There was no evidence of any great loss of ammonia, certainly not greater than is due to drainage in case of nitrate of soda. It is important, however, to apply the ammonium sulphate some time (about 14 days) before planting and to thoroughly incorporate it with the soil.

Classification of forms of humus in forest soils according to the conclusions of the International Association of Forestry Experiment Stations, ALBERT (*Ztschr. Forst u. Jagdw., 39 (1907), No. 1, pp. 3–8*).—The principal forms of nitrogen occurring in forest soils are classified and defined.

Industrial treatment of peat to increase its content of nitrogen in view of its application as a manure, E. V. H. BAZIN (*First Addition, July 3, 1906, to French Patent 360,484, Dec. 14, 1905; abs. in Jour. Soc. Chem. Indus., 25 (1906), No. 24, p. 1227*).—A method of making and operating a niter bed made of blocks of peat and supplied with effluent from sewage septic tanks is described.

Soil inoculation (*Country Life [London], 21 (1907), No. 527, pp. 182, 208, 209*).—A brief account is given of experiments by A. W. Sutton with American and German cultures which gave unfavorable results, this being ascribed to the use of old or inferior cultures.

German nitragin and American nitro-cultures as inoculating material for leguminous plants, T. REMY (*Centbl. Bakt. [etc.], 2. Abt., 17 (1906), No. 19–21, pp. 660–673, figs. 9; abs. in Chem. Ztg., 31 (1907), No. 11, Repert. No. 9, p. 53*).—The author reports bacteriological tests of American nitro-cultures which as in previous years gave negative results as regards the characteristic tubercle bacteria. In comparative inoculation tests of this material with nitragin in water cultures, pot tests, and field experiments on various leguminous plants the nitragin gave good results while the nitro-culture produced no effect.

Atmospheric nitrogen (*Amer. Fert., 26 (1907), No. 1, pp. 5–7*).—This article briefly discusses the relation of the world's supply of fixed nitrogen to the food supply, as well as the possibilities of adding to this supply by artificial methods of fixing the nitrogen of the air.

Fixation of atmospheric nitrogen, G. ERLWEIN (*Elektrotech. Ztschr., 28 (1907), Nos. 2, pp. 41–45, figs. 8; 3, pp. 62–66, figs. 13; abs. in Electrochem. and Metallurg. Indus., 5 (1907), No. 3, pp. 77–79, figs. 4*).—This paper describes in detail the theory and practical operation of the process of manufacturing calcium cyanamid, and discusses its uses and importance in the industries and in agriculture, summarizing the results of numerous comparative fertilizer tests of this material and of ammonium sulphate and sodium nitrate.

Future supplies of nitrogen for agriculture (*Cultura, 19 (1907), No. 222, pp. 77–98, figs. 8*).—Methods of preparing lime nitrogen and lime niter are described, and the agricultural value of these products is discussed. The importance of the acquisition of free nitrogen by leguminous plants is also considered.

The plants' supply of nitrogen, F. B. GUTHRIE (*Agr. Gaz. N. S. Wales, 18 (1907), No. 1, pp. 40–55, figs. 17*).—This article briefly discusses the formation

of nitrates in the soil, the assimilation of nitrogen by root-tubercle organisms, and the preparation and use as fertilizer of calcium cyanamid and lime niter.

The use of artificial nitrogenous fertilizers in agriculture (*Sucr. Indig. et Colon., 69 (1907), No. 6, pp. 154–158*).—The results of various experiments in France with calcium cyanamid as compared with nitrate of soda are summarized, its behavior in the soil is described, and precautions to be observed in its use are explained. A caustic or toxic effect on germination and plant growth was observed when the cyanamid was applied at or near the time of planting. Serious losses occurred when the material came in contact with moist substances.

The Birkeland-Eyde calcium nitrate (lime niter) as a fertilizer, J. Bjerknes (*Christiania: Norsk Hydro-Electrisk Kraelstofaktieselskab, 1906; abs. in Zentbl. Agr. Chem., 36 (1907), No. 1, pp. 3–11*).—The method of preparing this product is described, and pot and field tests of the fertilizing value of the material by various investigators are reviewed, the author's general conclusion drawn from the results being that lime niter is as effective as a source of nitrogen for plants as nitrate of soda and gives somewhat better general results on soils poor in lime.

Experiments with three new fertilizers. Experiments with cereals, E. Courrière (*Jour. Agr. [Paris], 41 (1906), II, No. 2087, pp. 769–772; Rev. Gén. Agron., n. ser., 1 (1906), No. 12, pp. 513–516*).—This is a brief summary of the results of various experiments with nitrate of lime, nitrite of lime, and calcium cyanamid.

The influence of different carbohydrates and organic acids on the denitrification process, J. Stoklasa and E. Vitek (*Ztschr. Zuckerindus. Böhmen, 31 (1906), No. 2, pp. 67–119; abs. in Chem. Ztg., 30 (1906), No. 98, Repert. No. 51, p. 435; Jour. Soc. Chem. Indus., 25 (1906), No. 23, p. 1162*).—This is a report of an exhaustive investigation in which the influence of a large number of sugars and neutral salts of organic acids on (1) ammonization bacteria which reduce nitrates to nitrites and finally to ammonia, and on (2) denitrification bacteria which reduce nitrates to free nitrogen, was studied.

Of the first class, including amoung others *Clostridium gelatinosum*, *Proteus vulgaris* and *P. zenkeri*, *Bacillus ramosus n. liquefaciens*, *B. mycoides*, *B. megatherium*, *B. subtilis*, *B. prodigiosus*, etc., *B. mycoides* reduced 20.69 per cent of the nitrate nitrogen present to ammonia in the presence of glucose, 1.9 per cent in presence of fructose, 1.72 per cent in presence of galactose, and 1.91 per cent in presence of arabinose; *B. subtilis*, 2.41 per cent in presence of glucose, 6.55 per cent in presence of fructose, and 6.22 per cent in presence of galactose; *C. gelatinosum*, 45.55 per cent in presence of arabinose and 9.68 per cent in presence of xylose; and *B. prodigiosus*, 2.58 per cent in presence of xylose. The reaction was in all cases relatively slow and was not alike with all the sugars. For instance, *P. zenkeri* reduced 13.1 per cent of nitrogen in presence of glucose, but none in presence of fructose.

Of the second class, including *Bacterium hartlebi*, *B. fluorescens liquefaciens*, *B. pyocyaneum*, *B. stutzeri*, *B. filefaciens*, *B. nitrororum*, *B. centropunctatum*, *Bacillus denitrificans*, *B. coli communis*, *B. typhi abdominalis*, etc. *Bacterium hartlebi* set free 93.97 per cent of the nitrate nitrogen in presence of glucose, 87.59 per cent in presence of fructose, 74.66 per cent in presence of galactose, 66.38 per cent in presence of arabinose, 83.38 per cent in presence of xylose, 84.48 per cent in presence of cane sugar, and 77.15 per cent in the case of milk sugar; *B. centropunctatum*, 5.17 per cent in presence of glucose; *B. nitrororum*, 5.17 per cent in presence of fructose; *Bacillus coli communis*, 5.43 per cent in presence of galactose; and *Bacterium fluorescens liquefaciens*, 7.08 per cent in presence of arabinose. The reaction was as a rule very intense both with the sugars and with the salts of organic acids, especially of lactic acid, and was

accompanied by a gradual breaking up into carbon dioxid and hydrogen or into carbon dioxid and water, the hydrogen produced exerting a very important reducing action.

Chlorates are reduced to chlorids, arsenates to arsenites, and ferricyanids to ferrocyanids in the same manner as nitrates are reduced to nitrites, the reduction being a result of the oxygen requirement of the denitrifying organisms.

Xylan and araban, the most abundant and widely distributed carbohydrate materials in soils and manures, yield on hydrolysis xylose and arabinose, which are very poor sources of carbon and energy for denitrifying organisms. It was found, however, that the typical denitrifying organism, *B. hartlebi*, assimilated 33.6 per cent of the total nitrate nitrogen in a nutrient solution containing arabinose and converted it into albuminoid compounds. Since obviously soils do not contain the easily assimilable carbohydrates in any such proportions as they are found in nutrient solutions, the denitrification process will not be so intense in soils as is indicated by laboratory experiments. In fact, in the author's opinion, denitrification plays an entirely secondary rôle in the soil to nitrification and ammonization.

The action of fresh green manuring plants (mixture of peas, beans, and vetches) and beet tops in comparison with nitrate of soda, W. Schneidewind, D. Meyer, and H. Frese (*Landw. Jahrb., 35 (1906), No. 6, pp. 923–926*).—The fertilizing value of nitrogen in a green manure mixture (peas, beans, and vetches), in beet leaves, and in nitrate of soda was compared on oats followed by mustard in pot experiments with two different soils.

Taking the effect of the nitrate of soda in increasing the yield as 100, the effect of the other forms of nitrogen were green manure 39.3 and beet leaves 36.5. The relative utilization of the nitrogen by the oat crop and the following mustard crop was as follows: Nitrate of soda 100, green manure 52.5, and beet leaves 43.

Fish fertilizers, A. Cligny (*Ann. Sci. Agron., 3. ser., 1 (1906), I, No. 2, pp. 166–187*).—This article summarizes information on this subject from a variety of sources, giving statistics of the industry in France and other countries, and discussing the fish fertilizers under two heads, fertilizers poor in phosphates, especially those made in America from the menhaden, and fertilizers rich in phosphates, especially those made in Norway.

Can the lactic-acid bacteria exert a preservative influence on barnyard manure? C. Barthel (*Deut. Landw. Presse, 33 (1906), Nos. 25, pp. 212, 213; 34, p. 292; abs. in Centbl. Bakt.* [etc.], *2. Abt., 17 (1906), No. 17–18, p. 567*).—The author reports experiments which show that by adding milk or other lactose-containing substances to manure a vigorous lactic-acid fermentation is set up, with consequent fixing and prevention of loss of ammonia.

A manure platform, M. Ringelmann (*Jour. Agr. Prat., n. ser., 13 (1907), No. 1, pp. 12–15, figs. 5*).—Different kinds of manure platforms, with or without shelter, sprinkling devices, etc., in use in France are described.

Report on the operations of the Brunswick sewage farm during 1895 to 1900, H. Beckurts and R. Blasius (*Ztschr. Hyg. u. Infektionskrank., 55 (1906), No. 2, pp. 232–294, map 1*).—Numerous analyses of the sewage water used, of the drainage water flowing away from the fields, and of the water of springs in the vicinity of the fields are reported, and the cultural management and financial returns of the farm are discussed.

The results show in general that the method of sewage irrigation was in this case an efficient method of purification without offense or injury to health of people living near the fields. The effluents from the fields were not found in any case to pollute springs of neighboring towns or of the Oker River, into which they were discharged. The agricultural products from the fields, especially the vegetables, were of good quality. The yield of grains was somewhat below the

average, but that of leguminous crops, grasses, and hoed crops in general was above the average. The total cost of the purification of the sewage of Brunswick by this method was about 23 cents per year and per capita of population.

Land treatment of sewage, H. T. SCOBLE (*Surveyor, 30 (1906), Nos. 770, pp. 448–452; 771, pp. 476–480; 772, pp. 500–503; 773, pp. 528–531; 774, pp. 556–559; 775, pp. 580–584; 776, pp. 608–611; 777, pp. 632–635; 778, pp. 664–669; 779, pp. 696–701; 780, pp. 716–719*).—A review of reports to the Royal Commission of England on this subject (E. S. R., 16, p. 1032).

Phosphoric acid experiments on different kinds of soils, W. SCHNEIDEWIND, D. MEYER, and H. FRESE (*Landw. Jahrb., 35 (1906), No. 6, pp. 927–936, pl. 1*).—The experiments here reported were made with 10 soils from different sources. The phosphoric-acid content of these soils and their behavior in pot experiments with oats when fertilized with phosphatic manures (superphosphate, Thomas slag, and bone meal) are shown in the following table:

Relation of phosphoric-acid content of soils to phosphate manuring.

Kind of soil.	Total phosphoric acid (dissolved by 10 per cent hydrochloric acid).	Phosphoric acid soluble in 2 per cent citric acid.	Phosphoric-acid content of the crop.		Response to phosphatic fertilizing.
			Grain.	Straw.	
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	
Heavy loess loam soil	0.81	0.45	0.86	0.16	No increase of yield.
Sandy soil	.16	.05	.92	.36	Do.
Do	.05	.02	.57	.06	Do.
Clay soil	.16	.01	.57	.07	Small increase of yield.
Sandy loam soil	.09	.01	.19	.06	Do.
Sandy moor soil	.07	.01	.63	.06	Decided increase of yield.
Loamy sandy soil	.05	.01	.63	.09	Do.
Loess loam soil	.08	.02	.45	.05	Do.
Heavy loess loam soil	.15	.02	.47	.06	Do.
Do	.08	.02	.63	.11	Do.

The results obtained indicate a certain relation in some cases between the phosphoric-acid content of the soil and the need of phosphatic fertilizers. In general, sandy soils poor in lime, magnesia, iron, alumina, and total phosphoric acid, but containing appreciable amounts of citric-acid-soluble phosphoric acid, did not respond to applications of phosphates. On the other hand, heavy soils rich in lime, magnesia, iron, and alumina were benefited by applications of phosphates even when containing much larger amounts of citric-acid-soluble phosphoric acid than the sandy soils. In other words, heavy soils rich in the constituents named must contain much more citric-acid-soluble phosphoric acid than sandy soils of the kind described before phosphatic fertilizers cease to be effective in increasing the yield.

Thomas slag gave as good results as superphosphate on light sandy soils, and bone meal was also very effective on such soils. In the heavy soils the Thomas slag was only 47 per cent as effective as superphosphate and bone meal was practically without effect. The efficiency of the latter apparently depends upon the reaction of the soil.

A rather definite relation between the phosphoric-acid content of the crop and the soil requirements was shown in these experiments, the soils producing plants low in phosphoric acid, as a rule, responding to applications of phosphatic fertilizers and vice versa.

Fertilizer experiments with different sources of phosphoric acid, H. J. PATTERSON (*Maryland Sta. Bul. 114, pp. 113–144*).—The experiments here recorded are a continuation of those reported in Bulletin 68 of the station

(E. S. R., 12, p. 930). They consisted of a comparison, on moderately stiff clay soil naturally quite well drained, of double superphosphates (both soluble and reverted), dissolved boneblack, dissolved South Carolina rock, iron and aluminum phosphate, boneblack, raw bone meal, phosphatic slag, ground South Carolina rock, and ground Florida soft phosphate, these materials furnishing all forms of phosphoric acid found in fertilizers and including all of the phosphates generally found in the market at the time the experiment was begun.

The average results on 6 crops of corn, 2 of wheat, and 3 of hay show that "(1) the highest total average yield was obtained with reverted phosphates; (2) reverted phosphate or iron and alumina [phosphate] produced a higher yield than reverted phosphate of lime; (3) insoluble phosphates produced a slightly higher total average yield than soluble phosphates and at about one-half the cost; (4) slag phosphate produced better results than bone meal and at less cost; (5) soluble phosphates produced the best yields of wheat; (6) Florida soft phosphate produced the best yield of corn; (7) reverted phosphates produced the best yield of hay; (8) insoluble South Carolina phosphate rock produced a higher total average yield than dissolved South Carolina rock; (9) insoluble South Carolina phosphate rock produced a little higher yield than boneblack; (10) bone meal produced a better yield of wheat than any other source of insoluble phosphate, but all other sources produced better grass."

General information on phosphates is given in an appendix to the bulletin.

The decomposition of dicalcium phosphate by water, K. Buch (*Ztschr. Anorgan. Chem., 52 (1907), No. 3, pp. 325–341, fig. 1*).—This is substantially a continuation of Rindell's work on the same subject first published in 1899.

A series of experiments is reported which show that under the action of water dicalcium phosphate is transformed into tricalcium phosphate. Whether this is the limit of the transformation or the latter continues until a basic compound is formed, the tricalcium phosphate being merely a comparatively stable intermediate product, was not determined, although there is evidence to indicate that this is the case.

On the intervention of micro-organisms in the utilization of insoluble phosphates of the soil by plants, S. de Grazia and U. Cerza (*Arch. Farmacol. Sper. e Sci. Aff., 6 (1907), No. 1, pp. 6–17; abs. in Chem. Centbl., 1907, I, No. 16, p. 1214*).—Culture experiments with *Aspergillus niger*, *Penicillium glaucum*, and *P. brevicaule* in media to which insoluble tricalcium phosphate was added are reported, showing that these organisms were quite active in rendering the phosphate soluble. The general conclusion drawn is that under ordinary field conditions a certain amount of insoluble phosphate is dissolved by the water which circulates in the soil and another considerable portion is dissolved by the action of micro-organisms, a part of the latter being used by the organisms in their growth and the remainder being immediately available for the use of the higher plants.

The action of the phosphoric acid of high and low percentage Thomas slag, W. Schneidewind, D. Meyer, and H. Frese (*Landw. Jahrb., 35 (1906), No. 6, pp. 937–940, pl. 1*).—The results here reported of pot experiments with oats and rye on artificial soil (75 per cent sand and 25 per cent of humus loam) indicate that the phosphoric acid of high percentage and low percentage Thomas slag are about equally effective pound for pound. The experiments further show that the phosphoric acid of slags insoluble in citric acid is practically without effect in increasing the yield of crops. With oats superphosphate, precipitated phosphate, and Wolter's phosphate (prepared by fusing raw phosphate with lime and silicates) were about equally effective and much more effective than

Thomas slag. Steamed Thomas slag was less effective than ordinary, and tricalcium and Florida phosphates were almost without effect. The largest amount of phosphoric acid was assimilated by the plant in the case of the superphosphate, followed in order by the precipitated phosphate and Wolter's phosphate.

Treatment of double phosphates of iron and aluminium in order to render the combined phosphoric acid soluble in ammonium citrate, Pilon et al. (*French Patent 368,521, July 30, 1906; abs. in Jour. Soc. Chem. Indus., 25 (1906), No. 24, p. 1227*).—A method of roasting such phosphates to increase their solubility in ammonium citrate is described.

Artificial fertilizers: Their nature and function, A. D. Hall (*Jour. Soc. Arts, 55 (1906), Nos. 2823, pp. 133–140; 2824, pp. 148–154; 2825, pp. 178–186; 2826, pp. 205–214; 2827, pp. 232–239, fig. 1*).—These articles constitute the Cantor lectures delivered before the Society of Arts in November, 1906, and discuss the general theory of the nutrition of plants, the sources and functions of nitrogen, phosphoric acid, and potash in fertilizers, and the importance of further investigation relating to the use of fertilizers. It is maintained that, while ordinary soils contain comparatively enormous quantities of nitrogen, phosphoric acid, and potash, they frequently do not contain these constituents in sufficient amount or available form for profitable crop production.

"A complete theory of manuring will always have two points of view, one special to the crop, the other to the soil; on good all-around soils, fertile loams and the like, the composition of the fertilizer employed will be dictated by the nature of the crop; on the more specialized soils, as on the pure sands, heavy clays or peats, it will depend primarily upon the soil."

In the discussion of the supply of nitrogen particular attention is given to recent progress in fixation of atmospheric nitrogen by micro-organisms in the soil and by electrical processes. It is pointed out that Great Britain is the most intensively farmed country in the world. It produces the largest crops per acre, but is obliged to spend the most to obtain them. This fact is made the basis of a plea for greater support for such investigations as are being carried on at Rothamsted relative to the increase of agricultural production.

The home mixing of fertilizers, F. Bonsteel (*Farming, 3 (1907), No. 1, pp. 22, 23, figs. 2*).—The advantages and disadvantages of this practice are briefly set forth. The equipment required and the methods of selecting and combining the fertilizer ingredients are described, and the special fertilizer requirements of a few crops are explained.

Protecting the farmer against fraud, J. P. Street (*Amer. Mo. Rev. of Reviews, 35 (1907), No. 205, pp. 213–216*).—The extent, methods, and advantages of inspection of fertilizers, feeding stuffs, and other agricultural materials in the United States are briefly reviewed.

To manure at a profit (*Mark Lane Express, 96 (1907), No. 3930, pp. 52–56*).—The sources of plant food available to the British farmer, the best means of determining the fertilizer requirements of the soil in a practical way, and the most profitable methods of using fertilizers are discussed.

Analyses of fertilizers, C. A. Goessmann (*Massachusetts Sta. Bul. 113, pp. 30*).—Analyses of commercial fertilizers collected in the course of regular inspection and of miscellaneous fertilizing materials sent to the station for examination are reported.

Report of analyses of samples of fertilizers collected by the commissioner of agriculture during 1906 (*New York State Sta. Bul. 285, pp. 81*).—"There are presented in this bulletin the analyses of samples of fertilizers collected by the commissioner of agriculture during 1906 and transmitted by him for

analysis to the director of the New York Agricultural Experiment Station, in accordance with the provisions" of the State fertilizer law.

Fertilizers, B. C. ASTON (*New Zeal. Dept. Agr. Ann. Rpt., 14 (1906), pp. 108–111*).—Analyses of a number of typical fertilizers are reported, including, among others, ashes from timber mills, fish manures, fowl manure, whale refuse, bone ash, basic slags, sterilized bone meal, calcium cyanamid, and castor pomace.

[Fertilizer market, New York, Chicago, Philadelphia, and Charleston] (*Oil, Paint and Drug Reporter, 71 (1907), No. 6, pt. 2, pp. 47–49*).—The fertilizer markets of these cities during 1906 are reviewed. It is stated that the year 1906 was "a most prosperous one to both the producers and manufacturers of the finished product." The larger use of fertilizers is ascribed principally to the raising of a big cotton crop, the South using during 1906, 500 lbs. of fertilizer to the acre, as against only 200 lbs. two years ago.

Circulars relating to the fertilizers and feeding-stuffs act, T. H. ELLIOTT (*Jour. Bd. Agr. [London], 13 (1907), No. 11, pp. 671–678*).—Reprints are given of circulars issued by the Board of Agriculture and Fisheries of Great Britain, giving the rules and regulations adopted by the board for the administration of the fertilizers and feeding-stuffs act of 1906.

AGRICULTURAL BOTANY.

Annual review of botany, F. PÉCHOUTRE (*Rev. Gén. Sci., 18 (1907), No. 6, pp. 234–248, figs. 15*).—A review is given of some of the more important contributions relating to chromosome reduction, parthenogenesis, sexuality in certain hybrids, experimental investigations on the origin of species, and sense organs in plants.

Botanical and agricultural studies in Java, W. DETMER (*Botanische und landwirtschaftliche Studien auf Java. Jena: Gustav Fischer, 1907, pp. 124, pl. 1*).—The author gives the results of his studies made in Buitenzorg during 1904 and 1905, the studies including vegetable physiology, forestry, and tropical agriculture. Following a general review of the agricultural practices in Java, chapters are devoted to comparisons between the plants and climates of Java and Central Europe; studies of Java soils; accounts of the cultivation of rice, tea, indigo, cacao, and cinchona; a description of the botanical garden at Buitenzorg; comparative studies between the primeval forests of Brazil and Java; investigations on the starch and sugar content of tropical and endemic plants; comparative studies of the transpiration of plants in Java and Jena; and a method of obtaining caoutchouc in Singapore.

The influence of climate on plant structures, C. HOLTERMANN (*Der Einfluss des Klimas auf den Bau der Pflanzengewebe. Berlin: W. Engelmann, 1907, pp. VIII + 249, pls. 16, figs. 7*).—The results are given of extensive anatomical and physiological studies made in the Tropics to determine the effect of tropical climatic conditions on the structure of plant tissues. Most of the investigations were made in Ceylon and confirmed in Java and elsewhere. Considerable attention is given to the transpiration of tropical plants, especially as influenced by the temperature and moisture relations. The different types of plant associations are described in considerable detail, after which chapters are devoted to the subjects of leaf fall and zonal, or the so-called year-ring, growth in the Tropics. A number of other interesting phenomena of plant growth in the Tropics are described, and the work concludes with a considerable list of publications relating to the investigations.

Variation in the sexuality of plants, D. BOIS (*Rev. Hort. [Paris], 79 (1907), No. 7, p. 153*).—Attention is called to the variations reported in sexuality of flowers of species of willow and *Pistacia terebinthus*.

In the case of the willow it is claimed that the flowers were more or less regularly hermaphroditic with a varying preponderance of male or female flowers, depending upon the water supply of the plants. Submergence of willows by the overflowing of rivers was found to markedly affect the character of the flowers. When submerged deeply and for a long time, most of the flowers noticed were male, while on plants of the some species that were only temporarily inundated female flowers predominated.

The observations on Pistacia were made of cuttings from the same plant, one growing in a dry situation, while the other was irrigated. The irrigated plant bore male, female, and hermaphroditic flowers in the same clusters, while the one in dry soil bore only unisexual flowers. The following year the water in the irrigation canal failed and the inflorescences of the plant growing on its banks contained only unisexual flowers.

The growth of plants and the absorption of mineral substances, R. CHODAT, A. MONNIER, and DÉLÉANO (*Bul. Herb. Boissier, 2. ser., 7 (1907), No. 4, pp. 350–352*).—The authors state that the growth of plants and each of the principal mineral substances taken up by them may be represented by a curve up to the maximum, after which there is not only less assimilation but a return to the soil of mineral substances actually takes place.

A series of experiments was carried on not only to demonstrate the law of absorption of mineral substances, but also to test the value of different nitrogenous materials for the growth of oats. The oats were seeded in plats on April 12 and received identical treatment, except as to the form of nitrogen. The forms of nitrogen given were nitrate of soda, nitrite of soda, sulphate of ammonia, and calcium cyanamid. One hundred plants were taken from each plat and analyzed at intervals of about a week from the beginning to the end of growth, a period of 74 days elapsing between the first and last analyses.

There was a constant acceleration in growth and absorption of mineral substances up to the forty-third day, when the plants were in full flower. From that date until the fiftieth day the increase took place more slowly, and after 50 days, when the grain was fully formed, there was a diminution not only in assimilation but also in the total dry weight, the ash, and all the mineral substances contained in the ash.

In the second part of the experiment it was found that nitrate of soda gave the highest yields not only of grain but also of straw, followed by sulphate of ammonia, calcium cyanamid, and nitrite of soda.

On the application of the theory of limiting factors to measurements and observations of growth in Ceylon, A. M. SMITH (*Ann. Roy. Bot. Gard. Peradeniya, 3 (1906), No. 2, pp. 303–375, pls. 4*).—Investigations were conducted with a number of tropical species of plants to test the theory of Blackman, which is essentially as follows: As a rule, a single one of the physical factors limiting the physiological processes of plants determines the rapidity of the process, and when the rapidity of the physiological process is determined by a number of factors the slowest acting will limit the rate of growth.

The author has studied temperature, water supply, light, atmospheric pressure, wind velocity, etc., as factors limiting growth, and he divides his results according to whether or not the plants experimented upon possessed a reserve supply of food material. It was found that for plants having an abundant reserve food supply the three factors that limit the physiological processes are

light, temperature, and water supply. Of these light is often the least important and in many cases is wholly negligible. The other two factors may limit growth equally throughout the growing period, or they may in turn become the limiting factor according as their intensities vary.

In these investigations the temperature considered was that of the growing organ itself and not that of the surrounding air. The water-supply factor was found to be very complex and to depend upon absorption and transpiration, which in turn depend upon soil temperature, the water content of the soil, humidity of the atmosphere, and intensity of light.

In cases of growth without reserve food supply the previous conditions pertain, but in addition there must be favorable conditions for assimilation and transportation. It is believed that the irregular conditions of growth in the laboratory can be accounted for by the supposition that several different factors upon which growth depends became limiting in turn for shorter or longer periods. In the case of plants under open-air conditions, when all the external factors are liable to variation, it is even more probable that the irregularities of growth curves can be explained in this way.

Inclosing single plants and its effect on a large number of important agricultural species, C. FRUWIRTH (*Amer. Breeders' Assoc. Proc., 2 (1906), pp. 197, 198*).—The object of the experiments which are briefly outlined was to ascertain the effect on seed production of inclosing the entire plant so as to prevent pollen from any other plant reaching it either by means of the wind or insects. The inclosing was done in a number of ways—oiled paper, linen bags, gauze, etc., being used for this purpose.

It was found that the following plants inclosed in this manner produced ample crops of seeds: Wheat, barley, oats, peas, several species of beans, vetches, camelina, opium poppies, beets, and tobacco. The following gave a greatly reduced quantity of seed: Rye, maize, *Vicia faba*, hairy vetch, a number of species of Brassica, crimson clover, carrots, timothy, meadow fescue, and meadow foxtail. No fruit or seed was produced from chicory, alfalfa, red clover, white clover, alsike clover, sulla, etc. In the case of sunflowers abundant fruits were produced, but the seed was sterile.

Correlation of characters in plant breeding, H. J. WEBBER (*Amer. Breeders' Assoc. Proc., 2 (1906), pp. 73–83, pl. 1*).—After defining correlations, the author groups them into environmental, morphological, physiological, and coheritat correlations. This latter group, which is the most interesting from a scientific standpoint as well as from that of practical value, is defined to include those characters which while not related to each other in any direct or casual sense are inherited as a single unit character. A number of correlations of this kind are pointed out in corn, peas, sugar beets, cotton, and other plants. A knowledge of these correlations is very valuable to the breeder, as it will enable judgment to be passed on the probable character of the product while the plants are still young or in their flowering stage.

The formation and distribution of essential oils in a perennial plant, E. CHARABOT and G. LALOUE (*Bul. Soc. Chim. France, 4. ser., 1–2 (1907), No. 6, pp. 280–290*).—The authors report a study made upon the absinthe (*Artemisia absinthium*) to determine the formation and distribution of the essential oil of that plant.

Studies were made of plants in all stages of growth, from seedlings to mature individuals, and it was found that the formation of essential oil took place most abundantly just previous to the period of flowering. Following this period there was a diminution in the essential oil, that material apparently being used in completing the ripening of the seed. In the roots of the young plants

no essential oil was present, and the stems contained relatively little, while it was abundant in the leaves. Later, after the period of flowering, it appeared in the roots, where its relative proportion was considerably increased with the age of the plant.

Vicianin, a new cyanogenetic glucosid occurring in the seed of vetches, G. Bertrand (*Bul. Soc. Chim. France, 4. ser., 1-2 (1907), No. 4, pp. 151-154*).—An account is given of the isolation of a new glucosid, vicianin, which yields hydrocyanic acid under the action of a ferment. The glucosid occurs in the seed of *Vicia angustifolia*. The sample analyzed contained 0.75 gm. of hydrocyanic acid per kilogram of seed.

The detection of formaldehyde in plants, G. Pollacci (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 16 (1907), No. 3, pp. 199-205*).—The author describes various methods for the determination of the occurrence of formaldehyde in plants and discusses its formation and function.

The relation of extractive to protein phosphorus in Aspergillus niger, W. Koch and H. S. Reed (*Jour. Biol. Chem., 3 (1907), No. 1, pp. 49-52*).—The authors report a series of experiments with *A. niger* to demonstrate a change in the relative proportion of protein phosphorus to extractive phosphorus. This mold was selected as it is known to grow relatively well with small amounts of phosphates, while higher plants would be stunted in their development. The growth was made on the usual culture media to which various percentages of phosphorus in different forms were added.

It was found that nuclein phosphorus is the most important form of phosphorus at the disposal of the cell. It is produced at the expense of other forms, except lecithin, and is not decreased even in extreme starvation. Lecithin phosphorus is next in order of importance, but it is thought that it probably takes no part in the building up of the nucleins. The extractive or water-soluble forms of phosphorus are believed to be the ones from which the others are built up, and they represent the intermediary steps between the phosphates and the more complex combinations of phosphoric acid.

Investigations on the respiration of flowers, A. Maige (*Rev. Gén. Bot., 19 (1907), No. 217, pp. 8-28*).—The author reports experiments on a considerable number of flowers to determine their respiration in relation to the stage of their development. In the experiments individual flowers were tested in some cases, while in others clusters of flowers were taken.

It was found that for most plants the intensity of respiration of the flowers decreased regularly from the youngest stages of the bud to the full opening of the flower. The rapidity of this decrease varied with the different species, and all sorts of intermediate forms were observed between maximum respiration in the small flowering buds and the maximum in the case of the open flowers. In a small number of species the intensity of respiration was found to increase with the stage of development of the flower, attaining a maximum upon the expansion of the flower. The respiration of individual flowers nearly always showed an increase from the younger stages to the opening of the flower. For most of the species investigated the dry weight was found to decrease in a similar manner with the development of the flowers, and the rapidity of this decrease varied with the different species under observation.

FIELD CROPS.

Results of cooperative tests of varieties of corn, wheat, oats, soy beans, and cowpeas, A. T. Wiancko (*Indiana Sta. Bul. 117, pp. 367-394, map 1*).—This bulletin contains a summary of the results of tests with leading varieties

of corn, oats, winter wheat, soy beans, and cowpeas conducted by farmers in 1906, when sets of seed of varieties of these crops were sent to nearly 600 applicants, representing 88 of the 92 counties in the State.

The number of tests of varieties of corn was 453, of which 409 consisted of 5 varieties each, selected by the station according to the adaptability to the sections where they were to be tested. For this purpose the State was divided into 12 sections, 1 and 2 constituting the extreme northern portion of the State and 11 and 12 the extreme southern portion. The object was simply to compare the 5 varieties under the same condition without any special effort to secure large yields. The average yields and the order of ripening in sections 1 and 2 were as follows: Early Yellow Dent 60.8, Cook Yellow Dent 59.9, Dunn Yellow Dent 60.3, Cook White Dent 60.1, and Funk 90 Day 64.9 bu. per acre. Early Yellow Dent ripened about 10 days earlier than Funk 90 Day. In section 3 the order of ripening and average yields were Early Yellow Dent 44.5, Funk 90 Day 47.5, Leaming 53.5, Reid Yellow Dent 55.5, and Silver Mine 50.4 bu. per acre. The difference in ripening between Early Yellow Dent and Silver Mine was about 2 weeks. In section 4 all the varieties ripened at about the same time, with the exception of Early Yellow Dent, which was a few days earlier than the rest. The average yields secured were as follows: Reid Yellow Dent 62.4, Leaming 60.8, Silver Mine 58.5, Golden Eagle 55.7, and Early Yellow Dent 54.7 bu. per acre. In section 5 Reid Yellow Dent matured first, being followed in the order mentioned by Riley Favorite, Pride of the Prairie, Leaming, and Boone County White, the difference between the first and the last named variety being about 2 weeks. Boone County White gave an average yield of 56.3, Reid Yellow Dent 55.8, Leaming 53.2, Riley Favorite 52.3, and Pride of the Prairie 50.4 bu. per acre. In section 6 Boone County White ripened on the average about 8 days later than the other varieties. The average yields were as follows: Boone County White 75.5, Leaming 70.4, Reid Yellow Dent 70, Golden Dent 68.6, and Riley Favorite 67.3 bu. per acre. In section 7 the order of ripening, beginning with the earliest variety, was Reid Yellow Dent, Golden Dent, Leaming, Pride of Indiana, and Boone County White, with the average yields 61.1, 57.2, 61.6, 66.6, and 65.6 bu. per acre, respectively. Reid Yellow Dent ripened about 2 weeks earlier than Boone County White. The order of maturity in section 8, with the average yields of the varieties, was as follows: Reid Yellow Dent 50.8, Golden Dent 47.3, Johnson County Yellow 48.9, Pride of Indiana 58, and Johnson County White 62.3 bu. per acre. Reid Yellow Dent and Golden Dent ripened practically at the same time. In section 9 Johnson County Yellow ripened first, followed in the order given by Gold Standard, Pride of Indiana, Vogler White Dent, and Johnson County White, the difference between the first and the last being about 10 days. The average yields of these varieties ranged from 62.1 bu. per acre for Pride of Indiana to 65.1 bu. for Johnson County White. In section 10 Reid Yellow Dent was about 12 days earlier than Johnson County White. In this section the range of average yields was from 57.4 bu. for Reid Yellow Dent to 67.2 bu. per acre for Johnson County White. Vogler White and Pride of Indiana both yielded 60.1 bu. per acre, while Gold Standard gave 63.4 bu. In section 11 the yellow varieties ripened about a week earlier than the white varieties, while in section 12 little difference was observed. In section 11 the average yields per acre ranged from 48.8 bu. for Gold Standard to 55.9 bu. for Johnson County White, and in section 12 from 53.2 bu. for Pride of Indiana to 56.2 bu. per acre for Johnson County White.

For the purpose of making variety tests with winter wheat the State was divided approximately into the northern, middle, and southern sections. In the northern section the average yield ranged per acre from 26.3 bu. for Mealy

to 30.4 bu. for Rudy. Two lots of varieties tested in the southern section varied in yield per acre from 27.3 to 32.1 bu. for the one and from 26.8 to 29.4 bu. for the other.

The 5 varieties of oats tested in the northern section gave average yields ranging from 31.1 to 47.8 bu. per acre, and in the southern section from 28.8 to 41.6 bu. per acre. Silver Mine, Great Dakota, and Czar of Russia were very similar in appearance and gave quite similar results. Swedish Select matured about the same time as Silver Mine, but had a much larger and plumper grain. Sixty Day and Early Champion matured about 10 days earlier than the other varieties, but gave considerably smaller yields.

Results with soy beans indicated that Ogema requires about 95 days to mature seed, Ito San and Early Brown about 115 days, No. 12399 about 130 days, and Medium Early Yellow approximately 150 days. In yield of seed per acre Early Brown ranked first, with 29.4 bu., and Ogema last, with 14.5 bu. for northern Indiana, Early Brown first, with 19.8 bu. and Ogema last, with 12.7 bu. for central Indiana, and Early Medium Yellow first, with 20.7 bu., and Early Brown last, with 13.4 bu. in southern Indiana.

The 8 satisfactory reports on tests with cowpeas showed that the varieties in order of maturity ranked as follows: Early Blackeye, Michigan Favorite, Whippoorwill, Iron, and Clay. The range in yield of seed per acre was in northern Indiana from 17.1 bu. for Early Blackeye to 19.3 bu. for Michigan Favorite, and in southern Indiana from 5.3 bu. for Clay to 11.3 bu. for Early Blackeye.

Department of field experiments, P. O. Vanatter (*Virginia Sta. Rpt. 1906, pp. 50–60, figs. 2*).—The results of experiments carried on in 1906 are briefly reviewed.

Of the varieties of winter wheat tested Blue Ridge and Mediterranean stood at the head, with a yield of 28.52 and 26.44 bu. per acre, respectively. Iron Clad, Blue Straw Fultz, Fulcaster, and Mediterranean had the highest protein content, analyzing 17.20, 16.80, 16.73, and 16.72 per cent, respectively. Blue Ridge ranked thirty-second in protein content, with 14.60 per cent. Turkey Red has not given good results at the station.

Two years' experience seems to indicate that the best time to sow winter wheat is from about October 1 to October 7, but it is stated that in certain sections east of the Blue Ridge sowing may be done from 2 to 4 weeks later. The work in seed selection with winter wheat shows that there is not so much to be gained by growing the seed from select choice heads as has been claimed. In experiments here reported the general average of the results shows an increase of only 3.96 bu. per acre in favor of large grains. It is believed that the safest and surest way of increasing the yield of wheat is to select individual plants of unusual promise, and work along this line has been inaugurated.

Union winter barley proved to be the best stooler and to make the quickest growth early in the fall. The best time to sow this crop seems to be about September 15, if the land is in good condition. This season Virginia Grey winter oats gave a better yield than Culberson, which made 38 bu. per acre on a ½-acre plat after cowpeas plowed under. Varieties of winter rye have not varied much in yield, although Excelsior is considered the leading sort.

Leaming, Boone County White, and Cocke Prolific corn have given good results on rich land. Better yields were secured from improved strains obtained by crossing pure-bred western corn with the best native varieties than from strains obtained by crossing the native sorts with the western varieties without using pure-bred strains.

Of different fertilizer applications made after cowpeas were plowed under 300 lbs. of Thomas slag per acre apparently increased the yield of corn per acre by 8.39 bu., 50 lbs. of potash per acre by 3.13 bu., 300 lbs. of floats per acre by

2.68 bu., and 300 lbs. of cotton-seed meal per acre by 1.79 bu. The largest increase, 31.93 bu. per acre, from different fertilizer applications for corn after winter wheat was secured from 300 lbs. per acre of cotton-seed meal.

The Japanese, Extra Early Black, Medium Green, and Ito San Yellow soy beans ripened September 1, 1, 15, and 30, and yielded 14.16 bu., 16.66 bu., 20.83 bu., and 22.50 bu. per acre, respectively. The Whippoorwill cowpea has given the best general results at the station. Five varieties of Canada field peas were all failures. Of 20 varieties of potatoes the 5 leading in yield were as follows: Burbank 230, Early Rose 227, Beauty of Hebron 224, Green Mountain 201, and Gold Coin 197 bu. per acre.

Field experiments in Staffordshire and Shropshire and at the Harper Adams Agricultural College, G. Balfour and J. C. Rushton (*Harper-Adams Agr. Col. Joint Rpt., 1906, pp. 43, pls. 2, dgm. 1*).—At the college the experiments in manuring meadow land, in progress since 1903, have shown that the use per acre of 10 tons of barnyard manure, together with an application of 1½ cwt. of nitrate of soda, 2½ cwt. of superphosphate, and ⅓ cwt. of sulphate of potash, gave the heaviest crop of all combinations tested, but that the use per acre of 2½ cwt. of superphosphate and ⅓ cwt. of sulphate of potash was the most profitable practice. The barnyard manure remained perceptibly effective for about 4 years. Superphosphate gave the most marked results, either alone or in combination.

Of 8 varieties of English and American wheats, Borwick Grey Chaff, Square Head Master, and Manitoba No. 1 led in productiveness, with yields of 56, 49, and 48 bu. per acre, respectively. Club wheat stood first in value for milling purposes, but gave the lowest yield, only 22 bu. per acre. Borwick Grey Chaff was poorest in milling quality. Of 5 varieties of barley, Carter Prolific ranked first in yield, with 40 bu. per acre, and also stood first in malting quality. Waverly, the best yielding of 9 varieties of oats, produced 71 bu. per acre, being followed by Garton Abundance, Thousand Dollar, and Highlander, producing 69, 66, and 63 bu. per acre, respectively. Thousand Dollar, Highlander, and Garton Abundance produced good, short, plump grains. The grain of Waverly, Wide Awake, Mounted Police, and Beslar Giant is considered too long and thin.

Commercial fertilizers applied with barnyard manure largely increased the average yield of mangels for 3 years. The use of 4 cwt. per acre of salt and of 4 cwt. of kainit, or ¾ cwt. of sulphate of potash, had a very marked beneficial effect on the crop in 1906. Dickson and Robinson Perfection, Sutton Prizewinner Yellow Globe, and Leighton Intermediate led in yield with 48 tons 15 cwt., 41 tons 7 cwt., and 39 tons 8 cwt. per acre, respectively. The largest yields of 30 varieties of swedes were obtained from Drummond Imperial and Carter Invicta. Ground lime at the rate of 10 cwt. per acre was more effective in reducing finger-and-toe disease than basic slag at the rate of 5 cwt.

The results of experiments in Shropshire were in favor of planting potatoes in rows 27 in. apart, of the use of immature Scotch and Irish seed potatoes, and of the boxing or sprouting of seed potatoes in boxes before planting. The largest total yields for the last 3 years were produced by Conquering Hero, Snowdrop, and Leda. Continued propagation from cuttings indicated a loss of vigor. The most expensive fertilization was the use of 20 tons of barnyard manure, and the most economical the use of 1¾ cwt. of sulphate of ammonia, 4¼ cwt. of superphosphate, and 1½ cwt. of sulphate of potash per acre. A complete application of commercial fertilizers with 15 tons of barnyard manure per acre gave this season a better yield of mangels than 7 cwt. of a special mixture applied under the same conditions.

The Staffordshire experiments showed that for fertilizing grass lands superphosphate is much more effective than bone meal or pure dissolved bone, and that

complete commercial fertilizers as a rule produced the best results. A ton of compressed yeast per acre in one test increased the crop of hay by 5 cwt. at a cost of 2s. per cwt., but in another experiment with mangels the yeast apparently caused a decrease in the crop. Home mixed fertilizers were found more effective and economical than special mixtures in growing potatoes, mangels, and turnips.

Report on culture tests for 1905-1906, A. DAMSEAUX (*Bul. Agr.* [*Brussels*], *22* (*1906*), *No. 7, pp. 943-952*).—The best yields of rye were secured with an application of 150 kg. of sulphate of ammonia per hectare, and the best yields of oats from the use per hectare of 400 kg. of superphosphate of lime, 100 kg. of sulphate of potash, and 100 kg. of nitrate of soda. Ligowo oats, which is highly esteemed for the quality of its grain, has a tendency to shatter and to ripen together with wheat, interfering with the harvest. In comparing 200, 300, 400, and 500 kg. of superphosphate of lime per hectare as a fertilizer for oats, the best results were secured with the applications of 300 and 400 kg.

Hanna barley yielded 2,400 kg. of grain and 4,200 kg. of straw, Chevalier 2,450 kg. of grain and 4,200 kg. of straw, and Polders 3,400 kg. of grain and 5,150 kg. of straw per hectare.

The results of fertilizer experiments with sugar beets show that on soils containing residual quantities of plant food, especially potash, the use of salt is not injurious to the beets, the production of sugar, or the purity.

Commercial fertilizers harrowed in or covered by hand gave practically the same results in fodder beet culture. Kirsche Ideal fodder beet proved much superior to the Eckendorf variety.

Notes are also given on the culture of potatoes, ruta-bagas, and colza.

Field tests with fertilizers, P. WAGNER (*Deut. Landw. Presse, 34* (*1907*), *Nos. 24, pp. 195, 196; 25, pp. 208, 209; 27, p. 221*).—The results of experiments conducted for 5 years on a sandy soil, poor in lime as well as in the three essential elements of plant food, show that the average annual profit where complete commercial fertilizer applications were made amounted to 123 marks per hectare. When phosphoric acid was omitted the profits were reduced by 84 marks, when potash was omitted by 96 marks, and when nitrogen was not applied by 63 marks. It is estimated that for every 100 marks expended for fertilizers an increase in yield valued at 223 marks was obtained.

It was further found that in order to produce a maximum yield of 30,000 kg. of potatoes, or 3,000 kg. of rye or oats per hectare, 45 kg. of phosphoric acid and 100 kg. of potash per hectare would have to be applied annually in a rotation of potatoes and two cereal crops, but if fodder beets were grown instead of potatoes 50 kg. of phosphoric acid and 125 kg. of potash per hectare would be required.

With reference to nitrogen the experiments showed that the use of 200 kg. of nitrate of soda per hectare gave the best general results.

A method of breeding a strain of alfalfa from a single individual, J. M. WESTGATE (*Amer. Breeders' Assoc. Proc., 2* (*1906*), *pp. 65-67*).—The method is described and results of certain experiments are briefly noted. From these experiments the author assumes as a working hypothesis that self-fertilization is not impossible but that the meager data on hand indicate cross-pollination to be the rule where different strains are allowed to grow side by side without preventing the visits of insects.

Judging the quality of barley, C. BLEISCH and P. REGENSBURGER (*Centbl. Agr. Chem., 36* (*1907*), *No. 1, pp. 33-35*).—In a study of this subject it was found that in connection with an increase in protein the nitrogen-free extract of barley in the samples examined decreased from 78.5 to 71.8 per cent, and the malt extract from 78.7 to 75.6 per cent, but that the curves of these two

factors were not quite parallel. The authors believe that a determination of the extract content is more reliable as a means of judging the malting quality of barley than the protein determination. An increase in protein was further associated with a high percentage of hull. It was also found that the malt extract produced from the dry matter of the grain decreased as the protein content increased. This fact was observed in practice as well as in laboratory experiments. In the process of malting the loss of protein was greater in high protein than in low protein barley.

A test of the producing power of some Texas seed corn, R. L. BENNETT (*Texas Sta. Bul. 92, pp. 8*).—The purpose of the experiment was to determine the variation in productiveness of corn grown by different persons, and of ears grown by the same person. Ears from a large number of farmers were tested, using an ear to a row 500 feet long. A low rainfall during winter and spring reduced the yield from all the ears. The highest yielding ear produced 26½ bu. per acre, or 12 bu. more than the average yield for all the ears.

Notes on the growing and selecting of seed corn and selecting and storing seed ears are given.

Practical corn breeding on a large scale, J. D. FUNK (*Amer. Breeders' Assoc. Proc., 2 (1906), pp. 89–93*).—This article describes fully each successive step of the corn breeding methods employed by leading corn breeders of Illinois.

Value of corn pollen from suckers v. from main stalks, C. P. HARTLEY (*Amer. Breeders' Assoc. Proc., 2 (1906), pp. 141–144*).—The results of the experiment reported in this paper indicate that the various ears produced by a stalk are of equal value for seed, that the pollen from the tassel of a sucker is of equal value with the pollen of the stalk that produces the sucker, and that the tendency to form suckers is hereditary and can be controlled by breeding.

Cotton culture, P. BONAME (*Sta. Agron. Mauritius Bul. 15, pp. 17–22*).—The following results were secured in comparative tests of varieties:

Results of variety tests of cotton in Mauritius.

Variety.	Cotton of good quality.	Seed cotton per plant.	Lint.	Yield per arpent.		
				Lint.	Seed.	Total.
	Per cent.	*Grams.*	*Per cent.*	*Lbs.*	*Lbs.*	*Lbs.*
Truitt	43	30	39	93	147	240
King	61	40	43	137	183	320
Seabrook	57	26	32	66	142	208
Excelsior	70	45	37	133	227	360
Culpepper	70	62	36	178	318	496
Parker	73	37	36	107	189	296
Sunflower	74	49	30	118	274	392
Russel	75	51	33	134	274	408
Allen	77	61	28	136	352	488
Sea Island	68	61	28	136	352	488
Georgia	71	54	26	112	320	432
Upland	68	45	34	122	238	360

Cotton in Algeria, F. GODARD (*Bul. Off. Gouvt. Gén. Algérie, 1907, Sup. 7, pp. 63–85*).—Cultural experiments carried on in the region of Philippeville in 1906 have shown that cotton can be profitably produced on nonirrigated lands in certain parts of Algeria. The 2 Egyptian varieties, Mit-Afifi and Yanovitch, particularly the first, appear well adapted to the coastal plains of the country and also to certain soils in the region of Philippeville. Georgia long staple proved the least resistant to drought, and its culture is therefore recommended only on the rich plains near the sea. Mississippi proved to be early and hardy and is believed to be better adapted to the higher altitudes than the other varieties mentioned.

The author recommends planting the Egyptian varieties and Georgia long staple 80 cm. by 50 cm., and the Mississippi at somewhat smaller distances. These directions are applicable only to nonirrigated lands. It is pointed out that where irrigation is practicable the yields are largely increased.

Leguminous crops for green manuring, C. V. Piper (*U. S. Dept. Agr., Farmers' Bul. 278, pp. 27, figs. 14*).—This bulletin discusses the use of green manures, the principal leguminous crops used for this purpose, how these crops get nitrogen from the air, and in general their adaptation to soil improvement. Descriptions are given of 9 different crops largely grown as green manures.

The Colorado potato industry, E. R. Bennett (*Colorado Sta. Bul. 117, pp. 23, figs. 15*).—This bulletin describes the potato industry of Colorado, which is largely confined to the Greeley, Carbondale, San Luis Valley, and Divide districts. In the Greeley and Carbondale districts the most popular variety is the Improved Peachblow, also known as the Red or White McClure. Other varieties largely grown there are the Pearl, White Beauty, Carman No. 1, and Challenge. Monroe County Prize, Rural New Yorker No. 2, Pearl, and Champion are commonly grown in the San Luis Valley district. The Divide district is the only place in the State of any extent where potatoes are grown without irrigation. A specialty is made here of seed potato growing, and as much of this seed is used in the Greeley district the same varieties are planted.

The methods of potato culture are described for each district and notes are given on diseases, insect pests, harvesting, marketing, seed selection, and the cost of growing.

Observations made on the amount of water used by the crop when grown on alfalfa land and old potato land are reported. On the old alfalfa land 13.76 in. of water was supplied by irrigation and 8.75 in. by rainfall, giving a total of 22.51 in. as the total water used on the crop. On the old potato land 4.41 in. less water was supplied by irrigation, which is attributed to the difference in the physical condition of the soil in the 2 fields. The crop on the potato land ripened earlier and gave a smaller yield than that grown on the alfalfa ground.

Report on trials of varieties of potatoes, 1906, D. A. Gilchrist (*County Northumb., Ed. Com., Bul. 9, pp. 83–90*).—At Cockle Park, Satisfaction ranked first in average yield among varieties grown for 3 years, and Dalhousie Seedling gave the best results in a list of varieties tested for only 2 years. Among the varieties tested at Dunbar, Factor, Dalmeny Acme, and Dalmeny Argon gave the best yields. In an experiment with tubers from different districts and countries the seed from Ireland and from Scotland produced the best crops.

With regard to winter and spring planting, it is shown that the heaviest crops were secured by planting early in March at Newcastle and early in April at Cockle Park. When the potatoes were not planted until May the results were much less satisfactory than from winter planting.

Potatoes for seed purposes (*Dept. Agr. and Tech. Instr. Ireland Jour., 7 (1907), No. 2, pp. 241, 242*).—Notes are given on the size of seed potatoes and the cutting and sprouting of the same, together with a summary of results of experiments on the sprouting of late potatoes from 1903 to 1906, inclusive. These experiments were cooperative and the yearly average gain in yield, due to sprouting before planting, ranged from 1 ton 13 cwt. to 2 tons 13 cwt. per acre.

Experiments with varieties of sugar cane, J. P. d'Albuquerque and J. R. Bovell (*Rpt. Agr. Work Barbados, Imp. Dept. Agr. West Indies, 1903–1905, pt. 3, pp. 67*).—The results of work with seedling and other varieties of canes, carried on at 2 central stations and 13 other estates situated in typical localities, are reported for the season 1903–1905.

On the 15 estates, 12 in the black soil and 3 in the red soil regions, B 1529 ranked first with 7,402 lbs. of sucrose per acre, with B 208 coming next with

6,744 lbs. White Transparent, the cane at present usually planted in the island, under the same conditions gave 5,799 lbs. per acre. In the rattoon crops of 6 black soil and 2 red soil estates, B 208 gave $2.58 worth of sugar more than White Transparent and B 1529 $14.08 less. B 376 has proved a promising cane, averaging as plant cane in the black soil districts $3.93 per acre more than the White Transparent. As plant canes on 3 red soil estates, B 208 produced sugar valued at $32.32, B 1529, $23.71, and B 376, $10.31 more than the White Transparent. As rattoons on 2 red soil estates White Transparent gave $16.27 per acre more than B 208, $2.85 more than B 376, and $80.85 more than B 1529. The data given also show that the average results with B 147 are better than those with White Transparent. An outline of future work is given.

Improvement of sugar cane by selection and hybridization, F. A. Stockdale (*Amer. Breeders' Assoc. Proc., 2 (1906), pp. 148–155*).—A description is given of this work as carried on under the direction of the Imperial Department of Agriculture for the West Indies.

The influence of direct sunlight and diffused daylight on the development of the sugar beet, S. Strakosch (*Separate from Österr. Ungar. Ztschr. Zuckerindus. u. Landw., 1906, No. 1, pp. 11, figs. 2*).—It was found that the sugar beet will reach its normal development when grown in diffused light, provided this is sufficiently strong. Direct sunlight, however, increased the substance in the plant, the increase being greater in the root than in the leaves. Growth in diffused light increased the nonsugars and decreased the percentage of sugar. The decrease in sugar content was not so marked as the decrease in the substance in the plant.

Intercellular transpiration proved to be stronger in the normal leaves than in those grown exclusively in diffused light, which, however, seemed to have a stronger epidermal transpiration. As compared with the plants grown in the shade, the leaves produced in direct sunlight contained larger-size stomata, and a larger number on the upper than on the lower side of the leaf. The translocation of the assimilation products in the shade-grown leaves was not so rapid as in the other plants. An increase in light intensity diminished the monosaccharids in comparison with the disaccharids of the leaves. Dextrose was found to be the predominating monosaccharid in the beet leaf.

The author concludes that the experiments suggest that the sugar in the beet leaf is not to be regarded as an intermediate product, but as a completely elaborated reserve material, which moves as such into the body of the beet.

The consumption of plant food by seed beets and transplanted beets, K. Andrlík, J. Urban, and V. Staněk (*Ztschr. Zuckerindus. Böhmen, 31 (1907), No. 6, pp. 339–350*).—This second report on the subject deals with the use of plant food by the seed beet, and the data presented show that for the production of 3,506 kg. of seed per hectare 162.4 kg. of potash, 140.5 kg. of nitrogen, and 49.4 kg. of phosphoric acid are required. The relation of the quantities of plant-food elements in the beet at the end of the growing period of the second year was as follows: Phosphoric acid 1, nitrogen 2.84, and potash 3.29.

Analysis of sugar beet seed, E. Schribaux and L. Bussard (*Semaine Agr. [Paris], 26 (1907), No. 1348, pp. 84, 85; Prog. Agr. et Vit. (Ed. l'Est), 28 (1907), No. 14, pp. 413–417*).—Based on the results of their investigations, the authors recommend that in the commerce of sugar-beet seed the following requirements be regarded as standard: That after 14 days of testing, the number of bolls germinating must be at least 70 per cent for the seed weighing less than 18 gm. per 1,000 bolls, 75 per cent for those weighing 18 to 22 gm., and 80 per cent for those weighing more than 22 gm.; that after 5 days of testing at least 80 per cent of the bolls capable of germinating must have produced a germ, or, in

other words, that the seed weighing less than 18 gm. per 1,000 bolls must have produced at least 56 per cent of sprouted bolls, those weighing from 18 to 22 gm. 60 per cent, and those weighing more than 22 gm. 64 per cent; and that the practice of giving the relative figures of sprouts per 100 bolls and per kilogram of seed be discontinued.

Variation in wheat hybrids, A. KEYSER (*Amer. Breeders' Assoc. Proc., 2 (1906), pp. 84–89*).—The observations made during two years of work with over 200 distinct crosses obtained from 11 different varieties and including 16 type crosses, are discussed.

A brief description of the varieties and their chief characteristics is given. With reference to the transmission of the bearded character it was found that the first generation was intermediate—that the progeny of this intermediate form broke up into 3 forms, awnless, intermediate, and bearded, and that the intermediate forms so obtained again broke up into 3 forms and more or less closely in conformity to the following ratio: Awnless, 25 per cent; bearded, 25 per cent; intermediate, 50 per cent. The author states that according to Mendelian nomenclature the intermediate form may be considered as a true hybrid.

Methods in wheat breeding, A. KEYSER (*Amer. Breeders' Assoc. Proc., 2 (1906), pp. 186–191*).—In a discussion of the subject the author states that in a study of all the progeny of a few mother plants to 3 generations it was found that the original mother plants showed wide variation in yield and composition, some producing a progeny varying widely, but averaging low in excellence; that some excellent mother plants produced uniformly very poor progeny, while others gave rise to uniformly good progeny; and that special qualities will be accurately represented in a composite from the best heads of the 5 or 10 best plants strong in the desired qualities. A method of wheat breeding taking cognizance of these facts has been evolved and is here described. The plan of the method is based upon straight selection without intervening hybridizations or crosses.

Breeding drought-resisting crops, R. GAUSS (*Amer. Breeders' Assoc. Proc., 2 (1906), pp. 108–112*).—The desirability of securing drought-resisting crops for regions of low rainfall and the possibility of obtaining them by breeding is noted, and the results of experiments begun in 1896 with wheat are reported.

Improved Fife wheat was used in this work. Sowing seed broadcast did not give satisfactory results, so the method of planting single grains at intervals of 12 in. each way was adopted. Although the results secured from wheat planted at the rate of one plant per square foot is not considered a measure of what might be obtained by thicker planting, the author believes that the best results with a wheat of a small grain are obtained when sown not thicker than a half bushel to the acre.

The yield secured from different varieties of wheat, barley, and rye in 1905 is given and it is shown that the wheat from grains selected from plants showing drought-resistance was much greater than from the other wheat varieties. With only one plant to the square foot the yield was at the rate of about 13 bu. per acre.

The author's theory of selection is based upon the presumption that plants which in growth and maturity show the greatest drought-resistance will transmit that constitutional difference to their offspring. The results of this work indicate that a variety of wheat acclimatized to arid conditions will be relatively light in weight and have small grains.

Second report on the influence of fertilizers on the yield of timothy hay, J. W. GILMORE and C. F. CLARK (*New York Cornell Sta. Bul. 241, pp. 19, figs.*

7).—The first report on this work, in which the experiments were described, has been previously noted (E. S. R., 17, p. 461).

In 1906 the fertilizer treatment was the same as in 1904 and 1905, with the exception that on one plat the quantity of nitrate of soda given was doubled and on another 640 lbs. of nitrate of soda was applied per acre instead of 160 lbs. of "niterlime."

Eight plats without fertilizer in 1906 gave an average yield of timothy hay of 3,365 lbs. per acre, 3 plats receiving only mineral fertilizers, 5,133 lbs., 7 plats receiving nitrate of soda with or without mineral fertilizers, 6,451 lbs., and 2 plats receiving nitrogen in stable manure, 5,885 lbs. The plat which received 20 tons of barnyard manure per acre in the fall of 1903, without a later application of any kind, yielded in 1906 7,420 lbs. per acre, as compared with 2,410 lbs. on the check plats. Six plats receiving a complete commercial fertilizer in varying amounts and proportions yielded at the rate of 7,057 lbs. per acre, while 4 unfertilized plats yielded at the rate of 3,192 lbs.

The relative influence of the different fertilizers is shown in the following table:

Results secured with different methods of fertilizer treatment.

Number of plats.	Fertilizer treatment.	Apparent increase in yield of hay per acre.		Average of 2 years.
		1905.	1906.	
		Lbs.	*Lbs.*	*Lbs.*
1	Nitrogen	1,216	1,723	1,470
1	Phosphorus	607	417	512
1	Potassium	954	1,224	1,089
1	Nitrogen and phosphorus	1,573	2,126	1,850
1	Nitrogen and potassium	1,900	2,470	2,185
1	Phosphorus and potassium	510	1,780	1,145
4	Nitrogen, phosphorus, and potassium	2,613	3,543	3,078
2	Manure, 10 and 20 tons	3,310	3,475	3,393

Some of the plats receiving a complete fertilizer received, however, larger amounts of the single elements than where only 1 or 2 elements were applied. If the plats on which the quantities of the elements remained the same are considered, the apparent increased yield with nitrogen, phosphorus, and potassium was 2,432 lbs.

The relation of nitrogen to phosphorus on the Dunkirk clay loam in the production of timothy hay seems to be important, for where in these experiments too large a proportion of acid phosphate to nitrogen was used there was an apparent depression in yield. An application of 640 lbs. of nitrate of soda per acre was too large for the soil and the climate. Aside from the use of stable manure the most satisfactory yield was obtained by applying per acre 320 lbs. of nitrate of soda, 320 lbs. of acid phosphate, and 80 lbs. of muriate of potash. The largest average yield was obtained by the use of stable manure. A single application at the rate of 20 tons per acre produced an apparent increase of 11.2 bu. of oats in 1904, 4,025 lbs. of hay in 1905, and 5,010 lbs. of hay per acre in 1906. When the application was at the rate of 10 tons, the apparent increase per acre was 5.3 bu. in the yield of oats in 1904, 2,595 lbs. of hay in 1905, and 1,937 lbs. of hay in 1906.

Descriptions and illustrations of the seed of the genus Nicotiana (Sinossi descrittiva ed iconografia dei semi del genere Nicotiana), A. Splendore (*Portici: R. Istituto Sper. Tabacchi Scafati, 1 (1906), pp. 163*).—The first volume of this work contains the descriptions of the seeds of the different types

and varieties of tobacco, with reference to their form, color, structure, dimensions, and weight.

The inspection of seeds under the Kentucky pure-seed law, H. GARMAN and M. L. DIDLAKE (*Kentucky Sta. Bul. 127, pp. 129–169*).—The working of the Kentucky pure-seed law is discussed and amendments to the same are suggested. A report on the samples examined is given and the details concerning adulterated samples are enumerated. The weed seeds most common in the samples are listed. Of the samples examined 36 were found adulterated as follows: Red clover 2, or 0.91 per cent; blue grass 12, or 8 per cent; orchard grass 21, or 19.4 per cent, and timothy 1, or 0.45 per cent. The text of the law is also given.

Commercial seeds of brome grass and of English and Kentucky blue grasses: Adulterants and substitutes and their detection, H. F. ROBERTS and G. F. FREEMAN (*Kansas Sta. Bul. 141, pp. 69–112, figs. 38*).—The seed and the plants of cheat, brome, and English blue grass are compared and described with a view to pointing out their distinguishing characters. The 3 species of plants are easily differentiated, and the seeds of brome grass and cheat are also easily distinguishable, but the seeds of cheat and of English blue grass resemble each other somewhat closely. The seeds of cheat frequently appear as a substitute for English blue grass seed and very often as an adulterant of it.

It is stated that every year nearly 700,000 lbs. of Canadian blue grass seed are used, chiefly for the adulteration of Kentucky blue grass. The 2 species of plants are easily differentiated, but the seeds are not distinguishable by the ordinary observer, and the distinguishing characters hitherto given are considered unsatisfactory aids to identification. This bulletin presents the following as "an absolutely new, hitherto unnoticed, and practically infallible test for distinguishing the seeds of Canadian from those of Kentucky blue grass:

"A careful examination of the palet in the two species shows a marked difference in the form and arrangement of the teeth on the lateral veins that we find to be constant for all cases where examined. In *Poa pratensis* [Kentucky blue grass] the palet is armed with teeth set well apart, long-acuminate, standing at progressively greater distances apart as the apex of the palet is approached, and finally disappearing short of the apex . . .; or, in rare cases, the teeth are wholly lacking. In *Poa compressa* [Canadian blue grass] the marginal teeth are shorter, blunter, not long-acuminate, continuous, not widely separated, becoming gradually smaller and of an equilaterally triangular form as the apex is approached; densely crowded together, like the teeth of a saw, without intervening spaces, and continuing up to the very apex of the palet . . ."

Increase in yield by treatment of the seed with concentrated plant food solutions, SCHLEH (*Fühling's Landw. Ztg., 56 (1907), No. 2, pp. 33–55*).—The different experiments show that this treatment has the same effect on germination as soaking in pure water, provided the solution is not injurious to the germinative ability of the seed. The increase in the yield of grain was in most cases no greater than that resulting from the treatment with pure water.

Seed soaked in a weak plant-food solution gave better yields than seed not treated, with the exception that seed treated with a one per cent solution of nitrate of soda was in most cases injuriously affected. Soaking beet seed in liquid manure reduced the development of the root, but produced a marked increase in the development of the leaf.

Coating the seed with a dense solution generally interfered with the process of germination. In some instances this method increased the yield of the

grain, while in others it caused a reduction. This treatment also seemed to favor the development of the stems and leaves, and thus showed a tendency to increase the yield of straw.

A method of eradicating Johnson grass, J. S. CATES and W. J. SPILLMAN (*U. S. Dept. Agr., Farmers' Bul. 279, pp. 16, figs. 8*).—The results of investigations on the eradication of Johnson grass are reported and discussed.

It appears that the best method is to turn the land into meadow or pasture, keeping the grass closely cropped, either by grazing or mowing, for 1 or more seasons. The grass should never be allowed to stand after blossoming. After the sod has remained undisturbed for a year shallow plowing, with subsequent cultivation, is recommended. Running an ordinary turning plow from 3 to 4 in. deep will generally turn up all the root stocks, and if the land is then planted to a cultivated crop and given good cultivation the Johnson grass may be eradicated. Any shoots missed by the cultivator should be removed by hand before heading out.

HORTICULTURE.

Report of the field horticulturist for 1906, O. B. WHIPPLE (*Colorado Sta. Bul. 118, pp. 16*).—A report of the field work for 1906.

Special attention has been paid to the treatment of fruit and orchard diseases and a study of orchard conditions in Mesa County, Colorado. The bulletin contains notes on the various diseases under observation and their treatment, as well as on copper-sulphate injury to fruit trees, the thinning of apples, grape growing, setting out young trees, and general orchard conditions.

Horticultural report, R. S. NORTHROP and J. T. ATKIN (*Utah Sta. Bul. 97, pp. 9–24, figs. 8*).—The southern Utah experiment farm, which was established in 1899, was organized as the Southern Utah Experiment Station early in 1905, and variety tests of grapes, orchard fruits, and nuts under way at that time have been continued. Experiments are also being conducted in grape pruning, training, and resistance of vines to phylloxera.

The soil at the station varies, the eastern half consisting of sandy loam, which grades to a heavy clay loam in the extreme western portion. This latter type of soil is said to contain more or less alkali, and some attention has been given to the selection of varieties of grapes for this kind of land. It has been found that while all of the grapes succeed better on the higher and lighter soils, the Cornichon, Purple Damascus, Golden Champion, and Thompson Seedless are the best yet tried on the heavy land. These varieties, together with Black Ferrara and Muscat of Alexandria, are also considered the most promising on the lighter land.

A list is given of the varieties planted in the spring of 1902 on the lower soil, with notes on those which have fruited, together with the names of the varieties which have been recently planted at the station, and illustrations of several varieties resistant to phylloxera.

While the study of the various phases of grape culture forms the chief subject of the station work, tests are being made of a large number of orchard fruits and nuts, of which a complete list is given, with notes on varieties which have fruited. Vegetable testing, the use of cover crops, and the evaporation of fruits are some of the problems to be taken up.

Report of the horticulturist, R. S. NORTHROP (*Utah Sta. Bul. 98, pp. 32–41*).—Thus far the horticultural work at the station appears to be of a preparatory nature. Some of the problems to be taken up include an experiment to be conducted for a number of years with reference to the duty of water as applied to orchard and small fruits, and the study of commercial varieties of apples.

The station nurseries contain a great number of varieties of orchard and small fruits, and a list is given of those to be planted in the spring of 1907. A study will also be made of root diseases, with particular reference to the liability of inoculation at the time of budding, grafting, etc., the possibility of disinfecting, and the likelihood of transmission to clean stock after planting by means of irrigation, cultivation, etc.

Phenology notes, 1906, CHARLOTTE M. KING (*Trans. Iowa Hort. Soc., 41 (1906), pp. 203–218*).—Popular data are given showing the blooming period of a great number of plant species, including flowers and fruit, as observed at 9 different localities in Iowa during 1906. The dates as given for different sections are found to bear a relation between the blooming time and the northward advancement of the season, as well as to different altitudes and latitudes. Similar data for 1904 has been previously noted (E. S. R., 17, p. 41).

Cabbages for stock feeding, S. FRASER (*New York Cornell Sta. Bul. 242, pp. 23–35, figs. 8*).—Popular directions are given for the planting, cultivation, treatment of insect pests and fungus diseases, marketing, and storing of cabbages grown for stock feeding, together with suggestions as to the methods of feeding, storing of seed cabbage, and seed production.

Tabulated data are also included, showing the results of variety tests of cabbage for the past 3 seasons.

The book of vegetables, A. FRENCH (*New York and London: The Macmillan Co., 1907, pp. XXVI + 312, pls. 7, figs. 144*).—This book consists of a planting table for the vegetable gardener, including all the well-known vegetables and garden herbs, together with many recent introductions from other countries. The vegetables are arranged in alphabetical order, and a summary is given of the uses and culture of each, together with the merits of newer varieties and brief directions as to suitable soils, planting distances and depths, thinning, the use of special fertilizers, etc.

This work is intended as a supplement to the more complete treatises on vegetable gardening.

Tomato investigations, T. H. WHITE and W. R. BALLARD (*Maryland Sta. Bul. 113, pp. 89–112*).—This bulletin contains a detailed report of tomato experiments conducted since 1897, together with notes for general information on the selection of soil, location, fertilizers, and cultural methods.

The results of spraying and training experiments and variety tests are presented in tabular form. As with previous work the present results indicate that spraying can be conducted profitably.

Increased yields obtained from plants grown on poles are attributed chiefly to the greater number of plants which can be grown per acre in comparison with the usual field culture.

Results from variety tests indicate that promising varieties of tomatoes quickly deteriorate when "roguing" and selection is not continued. Brief descriptions are given of varieties grown in 1906.

Experiences with the onion crop, H. PRICE (*Amer. Agr., 79 (1907), No. 15, p. 444*).—The author, who is an onion grower of Hardin County, Ohio, describes his treatment of the onion crop from seed to harvest, and states that he has obtained the best results with a fertilizer containing 3 per cent ammonia, 25 per cent available phosphoric acid, and 1 to 2 per cent potash. White Southport and Red and Yellow Globe are considered as the best varieties for commercial purposes in that section.

Horticultural novelties, C. M. UZAL (*Rev. Facult. Agron. y Vet. La Plata, 2. ser., 2 (1906), No. 4–6, pp. 336–342, figs. 4*).—Descriptions with cultural notes and illustrations of the bardana or gobo (*Lappa mayor, var. Edulis L.*) of Japan and the catawisa onion (*Allium fistulosum*). The gobo is an edible

variety of the common burdock of this country, the root, which is the part eaten, being prepared similarly to salsify. The catawisa onion, also known as the Welsh onion, is grown for its leaves and small aerial bulbels, which are said to be of value for pickling.

Biennial Report of Missouri State Fruit Experiment Station (*Missouri Fruit Sta. Rpt. 1905–6, pp. 18, pls. 4*).—The work of the station during the past 2 years has consisted primarily in the development of the variety orchard, together with some work in plant breeding, spraying demonstrations, and cooperative work in relation to pruning, cultivating, and the general care of orchards.

The station now has the following cross-bred and pure-bred seedlings: 10,000 strawberries, 1,070 apples, and 200 peaches, together with seed resulting from the crosses of 1906, numbering about 2,500 apples and 1,500 peaches. Of the 1,000 strawberry crosses which fruited during the past season, 50 varieties have been selected for further trial. Tables are given of the cross-bred and pure-bred peach seedlings, showing the parentage, description of the fruit, date of fruiting, resistance to disease, etc.

As the result of spraying for codling moth as high as 92.3 per cent of sound fruit has been obtained from sprayed trees, as against 19.1 per cent of wormy apples on unsprayed trees.

A list is given of the varieties of grapes grown at the station, showing their relative profitableness, susceptibility to disease, and value for table use or wine, together with notes on their growth.

In connection with the cooperative orchard work 4 plates accompany the text, illustrating pruning and clearing work.

Etherizing white Roman hyacinths, J. TAUBENHAUS (*Cornell Countryman, 4 (1907), No. 8, pp. 254–257, figs. 3*).—The studies were made in order to determine the influence of temperature upon the growth of etherized bulbs, and to determine whether bulbs after being etherized need a rest. The method of procedure, in substance, was as follows: The bulbs were etherized with sulphuric ether in a tight tin box, where they remained for 24 hours and were then planted in pots. The etherized bulbs were then divided into 4 groups, the bulbs of the first group being forced immediately, and the remaining bulbs being forced 2, 4, and 6 weeks, respectively, after etherization. Each of these groups was again subdivided, portions being forced in a hot house, a medium house, and a cold house. The first bulbs to bloom were the etherized bulbs which were forced 2 weeks after etherization in the medium house. In each group the etherized bulbs bloomed earlier than the check. The length of stem and quality of flowers differed between the etherized bulbs and the checks, the flowers being somewhat larger and the stems considerably taller and stronger in the case of the etherized bulbs.

As a result of these experiments the author comes to the following conclusions as far as the white Roman hyacinths are concerned: The etherizing of the bulbs appears to hasten the blooming period, to improve the quality of flowers and size of stems, and to increase the amount of flowers. The best method of procedure is to etherize the bulbs, then plant in pots and allow them to rest for 2 weeks, thus encouraging the formation of the roots. A medium temperature is considered best, as too much heat appears to hold the bulbs back for 3 or 4 days. Where earliness of bloom is not particularly desired, the bulbs may be etherized and rested for 2, 4, 6, or even 8 weeks at any temperature between 50 and 80° F., with good results.

Renewal of old orchards, F. H. BALLOU (*Ohio Sta. Bul. 180, pp. 89–110, figs. 14*).—This bulletin contains practical lessons in orchard renewal as conducted

at the Ohio Experiment Station, where a block of run-down apple orchard planted some 40 years ago was brought into profitable fruit production, in order to cover the interval from the time of planting young trees until they should come into full bearing. The various phases of the treatment are discussed and illustrated by several figures.

Based upon the treatment of this orchard, the author is of the opinion that old orchards can be renewed in such a way as to produce fine fruit for home and market while the young trees are growing and that the plan of renewal, which is a process of pruning down the trees, brings about conditions under which insects and fungi can be so easily and effectually combated and controlled as to reduce to a minimum the danger of their spread to younger plantations.

During the first season of renewal the topmost branches should be cut out, leaving all healthy side branches. The next season the horizontal branches may be pruned so as to promote a uniform, well-rounded, symmetrical head and top. Suggestions are given as to the method of pruning and dressing large wounds caused by severe pruning. Heading back should be followed up by discriminate thinning of the new shoots and by cutting back those selected for future fruit bearing.

Renewal of orchards may be profitably accompanied by the addition of stable manure, either worked in the soil or allowed to remain upon the surface mixed with straw as a mulch. Suggestions are also given for the renewal of orchards other than apple.

Prime causes of failure in orcharding, L. H. BAILEY (*West. N. Y. Hort. Soc. Proc., 1907, pp. 24–28*).—The author groups the causes of failure in orcharding into 2 classes: Crop-practice failures, and administrative failures, which are discussed in detail.

Fruit and orchard investigations, J. C. BLAIR (*Illinois Sta. Circ. 107, pp. 58*).—A list of some 24 problems, which at present seem to demand careful study, is placed before those interested in the development of Illinois horticulture, together with a brief statement regarding reasons why increased appropriations are being asked for experimental work in horticulture.

The circular also includes a discussion of investigations accomplished as a result of State appropriations, consisting of fruit-storage experiments (E. S. R., 14, pp. 356 and 1072), bitter-rot investigations, botanical investigations of horticultural interest, investigations on injury to apples by curculio (E. S. R., 16, p. 1098), comparison of the relative merits of liquid and dust sprays for apples (E. S. R., 17, p. 1093), spraying for second brood of codling moth, fertilizer and drainage experiments, a study of the yellow leaf and brown spotting of foliage of fruit trees, and demonstration work. Bulletins are to be prepared during the coming year giving the details of the several lines of investigation not already reported.

The banana, P. HUBERT (*Le Bananier. Paris: H. Dunod & E. Pinat, 1907, pp. X + 222, figs. 46*).—This is the second of a series of practical books on Colon, Colombia, which the editors propose to publish. In this work the banana is treated from an agricultural, industrial, and commercial standpoint.

Part 1 deals with the origin, botany, varieties, and climatic and geographical distribution, together with methods of planting, cultivation, and subsequent care of bananas both for fruit and fiber. A chapter is also devoted to estimates of cost and returns in the development of a banana plantation. Part 2 treats of the selection of bananas for exportation and home consumption, and the manufacture of starch, sugar, alcohol, wine, brandy, vinegar, and fiber, together with the use of bananas for animal feeding. Part 3 is devoted to a discussion of the economic and commercial importance of the banana in various countries.

Fruit list (*Trans. Iowa Hort. Soc., 41 (1906), pp. 220–225, charts 4*).—A list is given of apples, crabapples, plums, cherries, grapes, and small fruits suggested as standard varieties for Iowa, together with a list of supplementary varieties. Varieties are indicated which appear to be specially adapted to the northern drift soil and to the southern loess soil. Charts are included showing the nature of the soil, elevation, rainfall, and temperature throughout the State, for the purpose of assisting those interested in the study of varieties.

Methods and results of hybridizing fruits, T. WILLIAMS (*American Breeders' Assoc. Proc., 2 (1906), pp. 184–186*).—The author enumerates some of his results in hybridizing various stone fruits, apples, and a few pears. The origin of the Victor Sand Cherry, Red Glass, and Red Glass Junior plums is given, together with the crosses which were used to produce fruit of desired characteristics. He has been successful in reproducing the Talman and the Sickle pear and hardy types of peaches, as well as a hardy apricot, in eastern Nebraska. A new method of grafting was used, which is not clearly described, but which appears to be a modified adaptation to scion-grafting of the method employed in budding trees.

Breeding hardy raspberries for the Northwest, N. E. HANSEN (*American Breeders' Assoc. Proc., 2 (1906), pp. 128, 129*).—The author points out the great need of hardy raspberries for the Northwest prairie region and reports the results secured from his efforts of the past 10 years at the South Dakota experiment station in securing hardy varieties. A large number of native raspberries were gathered from the Dakotas, Minnesota, Manitoba, and Assiniboia, together with varieties from three different continents.

Out of many thousands of seedlings which have been raised under high cultivation, several of those which have fruited have been selected as worthy of propagation. One variety, named the Sunbeam, has proven especially promising. It is a hybrid of Shaffer Colossal with a wild red raspberry from North Dakota and is said to be vigorous, productive, and capable of enduring severe winter conditions. The author states that the work is to be continued until varieties are secured which are not only hardy but adapted to a large area.

The strawberry test plot, F. H. BALLOU (*Ohio Sta. Bul. 178, pp. 41–68, figs. 22*).—Notes on 109 varieties of strawberries tested at the station during the season of 1906. The numerous varieties are described in detail and in a majority of cases illustrated. The results for each variety are tabulated, showing the sex of the flower, the dates of first blooming and ripening, periods of heaviest fruiting, largest single picking, date of last picking, and total yield in quarts for the season.

Grape breeding, S. A. BEACH (*American Breeders' Assoc. Proc., 2 (1906), pp. 191–197*).—The historical development of commercial varieties of grapes and the grape industry in the eastern portion of the United States is outlined. The author states that in 1848 only two native grapes, viz, Isabella and Catawba, were placed on a selected list of fruits for general cultivation as adopted by the Congress of Fruit Growers assembled in New York. Since that time a large number of varieties have been developed in the eastern portion of the United States, but their parentage is, for the most part, either vague or entirely unknown. Reference is made to the work of several prominent grape hybridizers, and the origin of many well-known varieties is given.

For a better system of grape breeding more attention should be paid to the varieties which are now available for breeding, in order that the characteristics of the resulting crosses may be foretold with some degree of certainty. In his own work at the New York State experiment station, which has been carried on for over 14 years, the author has succeeded in making certain combinations

of parents which will always produce white-fruited seedlings and others in which red is the fixed color. In all, about 225 groups of grape seedlings have been bred in this way.

Length of life of vines of various species and varieties of grapes; profitableness; and by what diseases seriously affected, T. V. MUNSON (*Texas Sta. Bul. 88, pp. 18, figs. 9*).—The author presents data covering a period of 19 years, secured for the most part from his records of an 8-acre grape vineyard planted in 1886–7 near Denison, Texas. The soil in this vineyard is a light sandy soil from 6 in. to 3 ft. deep, with a red and yellow clay subsoil. The land has had but one application of fertilizer, consisting of a heavy coat of cotton-seed meal some 12 years ago. Data have also been collected from vineyards grown on different soils, including "black waxy" and lime soils.

In table 1 the relative longevity, health, and vigor of 26 species of grapes grown in the vineyard at Denison are noted. The species usually found native to lime soils are distinguished from those native to sandy soils. Table 2 gives the names of each variety cultivated, the specific blood, the number of vines of each planted in 1887, and the number and percentage alive in 1905, together with notes on the color, economic value and use of the fruits, and condition of the vines in 1905. The varieties are noted which have been found suitable for "black waxy" soils with clay subsoils, and for "black waxy" and "adobe" soils underlaid with white rock as near as 2 ft. from the surface.

The author presents data on extensive personal observations and reports secured from different experimenters in Texas on the adaptability of different varieties of grapes for the limy soils in Texas. It is stated that all species and varieties grow well in sandy soils where carbonate of lime does not exceed 25 per cent of the soil. Some species will flourish in soils which contain as high as 40 to 60 per cent of lime.

Varieties much subject to rot and mildew are not recommended for planting in the humid forest region of east Texas unless spraying with sulphate or carbonate of copper solution is thoroughly attended to. Grapes are not considered to succeed well in boggy or seepy soils on account of late frosts and fungus diseases.

The text is accompanied with plates illustrating several species of grapes.

Reestablishment of vineyards in Charente, France, J. M. GUILLON (*Jour. Agr. Prat., n. ser., 13 (1907), No. 10, p. 307*).—Many of the vineyards of Charente, France, containing poorly adapted graft stocks are being reestablished. For the purpose of aiding this work the author here presents brief notes on the value of the principal stocks for grafting, resistance to phylloxera and to drought, adaptability to different percentages of lime in the soil, fruitfulness, etc.

The economics of viticulture, A. MARESCALCHI (*Coltivatore, 53 (1907), Nos. 8, pp. 229–231; 9, pp. 263–267; 10, pp. 295–298; 11, pp. 327–330; 12, pp. 367–370; 13, pp. 393–396; 14, pp. 426–428, figs. 10*).—In a series of short articles the author considers the economic side of the various phases of grape culture, including the equipment, preparation of the soil, various planting systems, cultural and spraying methods, systems of training, subsequent care, and cost of labor.

Male or seedless cocoanuts, A. W. BARTLETT and J. BELLING (*Agr. News [Barbados], 6 (1907), No. 128, p. 87, figs. 4*).—Notes are here given, together with illustrations, of seedless cocoanuts found in British Guiana. It is stated that these cocoanuts are sometimes found growing on trees with perfect fruit and at other times on trees which produce only seedless fruit. They may be distinguished from perfect fruit by their shape, the seedless fruit being much narrower.

Vanilla, F. L. TUERO (*Rev. Agr. [Santo Domingo], 3 (1907), No. 24, pp. 393–397*).—An account of the sorting, grading, and packing of vanilla, together with its chemical composition, uses, and adulteration, and estimates of the profits of a vanilla plantation.

The total cost per hectare of vanilla is estimated as $469.35, and the gross returns in products as $1,630, leaving a net return of $1,160.65.

FORESTRY.

Farm forestry, E. J. ZAVITZ (*Ontario Dept. Agr. Bul. 155, pp. 40, figs. 27*).—This is a popular bulletin intended to aid the farmer in developing a rational treatment of wooded lands and in reforesting waste portions of the farm.

The subject is treated under 2 general headings, the woodlot and forest tree planting. Under the woodlot the injury from fires and stock grazing are discussed, and directions are given for making the woodlot a permanent and paying part of the farm. The portion devoted to forest tree planting deals with tree planting in relation to the farm and the small landowner, including a discussion of the choice of species with reference to their hardiness, rate of growth, nature of soil, kind of wood crop desired, and availability of planting material.

Directions are also given pertaining to nursery and planting methods, the planting of swamp lands, planting clumps for protection of stock, storm protection belts, and planting along permanent fences. Lists are given of 72 trees indigenous to Ontario, and of a large number of trees introduced from the United States and other countries.

The level of subsoil waters with regard to forest, R. S. PEARSON (*Indian Forester, 33 (1907), No. 2, pp. 57–68, pls. 3*).—In order to determine the effect of forest growth upon the level of subsoil waters as compared to cleared lands, during 1904 and 1905 the author took a series of readings both in and outside the Mohulia forest in India. An outline, together with tabular data, is given of these readings, as well as a description with charts of the results secured from similar experiments by M. Ototzky in Russia (E. S. R., 16, p. 672) and M. Tolsky in Russia and M. Henry in France (E. S. R., 15, p. 125).

Upon comparing the results of these experiments the author reaches the following conclusions: In all cases the water levels inside the forests are lower than those outside the tree influence during the same period. The water level is steadier and the effect of rain is felt later inside the forest than outside. It has been shown in Europe that the difference of the level is greater farther inside than on the edge of the forest, and that old woods lower the level more than young woods. In India the effect of a short rainfall in any given year takes more than one normal rainfall to compensate the former deficiency. The amount of rainfall in any locality has a marked influence on the difference of level in and outside of forests. Thus, in a low rainfall area the difference of levels is greater than where the rainfall is more abundant.

Report of forest administration in the Andamans for 1905–6, F. TRAFFORD (*Rpt. Forest Admin. Andamans, 1905–6, pp. 33*).—This is a report of the progress of the year 1905–6 in the State forests of the Andaman Islands, and includes a discussion of the constitution and management of State forests, the preparation of working plans, forest protection, sylviculture, exploitation, etc., together with a financial statement of the year's work. The important features of the work are presented in tabular form.

During the year 606,198 cu. ft. of timber were extracted by government agency, as compared with 493,601 cu. ft. last year. The surplus of revenue over and above the expenditure was 236,539 rupees, as compared with 247,843 rupees

last year. One of the principal features of the work was the exploration of the forest of the South Andamans, and the completion of a working plan for these areas by F. H. Todd.

The reforestation in the department of Aube, France, L. Pardé (*Rev. Eaux et Forêts, 46 (1907), No. 7, pp. 193–207*).—The author here presents notes submitted by M. Ména, conservator of forests and streams at Troyes, on private reforestations which have been carried out in the department of Aube during the last half century.

The department is divided into 6 regions according to the nature of the soil, and descriptions are given of the work of reforestation in each of these regions.

Native trees of the Transvaal, J. Burtt-Davy (*Transvaal Agr. Jour., 5 (1907), No. 18, pp. 413–433*).—The author has been engaged for some time in the publication of an illustrative and descriptive account of Transvaal trees. The present work is a preliminary classified catalogue of the species, with notes as to their distribution.

The native trees of the Transvaal are said to occur in well-marked phytogeographic zones of vegetation. These zones are indicated and alphabetical lists are given of the species occurring in each, together with a list of families arranged alphabetically under their main divisions and classes. The total number of trees classified consists of 57 families, which are subdivided into 132 genera and 269 species.

Soap trees, R. Guenther (*Daily Consular and Trade Rpts. [U. S.], 1907, No. 2852, p. 4*).—In a brief note reference is made to a large plantation of soap trees at L'Arba, near Algiers, from which several thousand tons of berries are said to be gathered annually. The tree is described as resembling an apple tree of medium growth. The fresh fruit is green and its pulp surrounds a kernel containing a yellowish, gelatinous, sticky substance which is said to contain three times as much soap as the "panama" wood. This soap is expected to be of great service to the cloth and linen manufacturers, as well as for domestic purposes, since it can be used to clean linen and silken fabries and colored embroideries without causing the colors to run together.

Caoutchouc, E. Levasseur (*Rev. Écon. Internat., 1 (1907), No. 3, pp. 607–624*).—This is a discussion of the development of the rubber industry in various tropical countries of America, Asia, and Africa, including a description of the methods of exploitation, species grown, statistics for a period of several years as to the exportation of rubber from the principal rubber-producing countries, the importations to the principal rubber-consuming countries, and the value of different grades of rubber.

On the occurrence of calcium oxalate in the barks of the eucalypts, H. G. Smith (*Jour. and Proc. Roy. Soc. N. S. Wales, 39 (1905), pp. 23–32*).—The barks of the Mallees, or dwarf species of eucalyptus of New South Wales, were examined to derive information with regard to their tanning value, as well as to make clear some of the problems connected with these dwarf species, which occur in large quantities in many parts of Australia.

From all the different species examined, calcium oxalate crystals were separated in varying quantities, ranging from 16.66 per cent in *Eucalyptus gracilis* to 0.08 per cent in *E. morrisi*. The general appearance and thickness of several barks tested are described. The species which contain crystals in the greatest abundance seem to be those which have a very thin, smooth bark, or at most a but slightly persistent bark at the base. It has already been determined that in those barks which contain much calcium oxalate the tannin is decidedly superior to that found in species in which the crystals are present only in small amounts.

Progress of wood preservation in 1906, C. G. CRAWFORD (*Forestry and Irrig., 13 (1907), No. 3, pp. 132–138, figs. 3*).—In this paper, which was originally presented at the annual meeting of the Wood Preservers' Association, Memphis, Tenn., January, 1907, the author discusses the advancement made in the preservation of wood during the past few years.

Prior to 1901 there were about 15 timber-treating plants in the United States. At present, they number about 50, 5 having been erected in 1906 alone. The author states that consumers now realize that artificial preservation must be employed, not only because the renewal of certain species of wood is unusually expensive, but because such preservation greatly reduces the amount of structural timber required. The investment of large sums in extensive engineering enterprises is also creating a prudent regard to the future supply of timber.

The activity in wood preservation is said to have manifested itself along the following lines: An increase in the number and capacity of treating plants, improvement in the existing methods, the introduction of new methods from abroad, together with the development of methods peculiarly American and designed to meet American requirements, and a promoting of a more careful and detailed study of the technology of American woods, with an investigation of the constituents and properties of the preservatives in general use. The author discusses these various phases somewhat in detail.

Forest products of the United States, 1905, R. S. KELLOGG and H. M. HALE (*U. S. Dept. Agr., Forest Serv. Bul. 74, pp. 69*).—This bulletin contains detailed statements upon the lumber cut, cross-ties, tight cooperage stock, tan bark, and the wood used for mine timbers, pulp, veneer, and distillation in 1905.

The subject-matter has been previously published in a series of Forest Service circulars (E. S. R., 18, pp. 447, 448, 642, and 745).

The timber supply of the United States, R. S. KELLOGG (*Forestry and Irrig., 13 (1907), No. 4, pp. 187–193*).—A large number of statistics upon the timber supply of the United States are brought together in convenient form for comparison and reference. These statistics are derived for the most part from census reports, bulletins of the Forest Service, and lumbermen's estimates.

Tables are given and discussed showing the lumber cut by States of the United States from 1880 to 1906, inclusive, the estimated stumpage of the United States from 1880 to 1905, and the estimated stumpage and cut of yellow pine in 7 southern States.

DISEASES OF PLANTS.

A text-book of fungi, G. MASSEE (*London: Duckworth & Co., 1906, pp. XI+427, figs. 141*).—The author's object in this book is to call attention to some of the more recent contributions on the morphology, biology, and physiology of fungi, and to indicate where further information on these lines of research may be obtained.

After a discussion of the anatomy of fungi, accounts are given of the formation of spores, methods of reproduction, effects of various physical and chemical agents on growth of fungi, parasitism, symbiosis, biological forms, geographical distribution, ecology, etc. A special chapter is given to the author's views on the phylogeny of fungi, and, after a description of the diseases due to fungi, their propagation, and legislation regarding plant diseases, a general scheme of classification is presented, which is a modified form of that of Brefeld.

Report of the plant pathologist, R. E. SMITH (*California Sta. Bul. 184, pp. 219–258, figs. 12*).—A review is given of the work carried on by the plant pathologist during 1906, the principal investigations having been made on pear blight, walnut blight, brown rot of lemons, beet blight, peach blight or shot-hole

fungus, tomato diseases, and asparagus rust. In addition, investigations have been begun on rose diseases and citrus fruit diseases.

The pear blight work is largely in cooperation with the Bureau of Plant Industry of this Department, and consists in the application of the methods recommended by that Bureau. A detailed account of the investigations in the different counties is given. It has been found that thorough winter pruning prevents blossom infection in the spring, and that the larger the district covered in the winter the less will be the infection the following season. Frequent and prompt summer cutting is to be practiced, and if not exposed to extremely abundant infection, a pear orchard can be profitably maintained in good condition.

The walnut blight investigation has been a continuation of studies on the bacterial disease of walnuts due to *Pseudomonas juglandis*. Thus far the disease has proved difficult to control, as spraying experiments have not been very successful. The size of the trees made spraying almost prohibitive, on account of the difficulty and expense.

The investigations on lemon rot, due to the fungus *Pythiacystis citrophthora*, have been previously described (E. S. R., 18, p. 344).

The beet blight described appears to be due to a derangement in the normal functions of the plant, and investigations seem to show that by attention to planting and cultivation in connection with weather conditions the disease may be largely controlled.

The peach blight or shot-hole fungus reported upon is due to a species of Coryneum, and spraying with Bordeaux mixture proved quite efficient in controlling it. In addition to the peach, the almond is subject to this disease, and probably the fungus will be found to attack other stone fruits.

The tomato disease investigations are briefly summarized from a previous publication (E. S. R., 17, p. 1082).

The other investigations are briefly described, and the bulletin concludes with a list of the more common plant diseases that have been observed throughout the State, with notes as to their relative importance.

Report of the government mycologist, T. Petch (*Circ. and Agr. Jour. Roy. Bot. Gard. Ceylon, 3 (1906), No. 21, pp. 277–286*).—Among the fungi observed during the year the author reports particularly upon leaf and root diseases of tea, Para rubber, cacao, Castilloa, and cotton.

The tea diseases attacking the leaves were gray blight (*Pestalozzia guepini*), brown blight (*Colletotrichum camelliæ*), and *Cercospora theæ*. The root disease was principally due to the fungus Rosellinia. Stem diseases due to Nectria are also described.

The leaves of *Hevea brasiliensis* were found to be attacked by *P. guepini*, *Helminthosporium heveæ*, *Glœosporium brunneum*, and *Colletotrichum heveæ*. The root diseases described were caused by *Fomes semitostus*, *Poria vincta*, and an undescribed species of Hymenochæte. A blackening and decay of Hevea fruits, which was observed to be especially destructive, was due in most instances to a species of Phytophthora, similar to that found on cacao pods in other countries. In addition, the rotting fruits showed the presence of *Sphæronæma album*, *Nectria diversispora*, and *Diplodia zebrina*.

The species of Hymenochæte which occurs on Hevea was found attacking cacao as a root parasite in several instances and also destroying the roots of cotton.

The principal parasite observed on Castilloa was *Botryodiplodia elasticæ*, which attacked trees the bark of which had suffered injury.

Indiana plant diseases in 1906, F. D. Kern (*Indiana Sta. Bul. 119, pp. 427–436*).—Lists are given showing the distribution of various plant diseases

throughout the State in 1906, and reports obtained from cooperative correspondents form the basis for calculating the losses due to these causes. The diseases are listed under the headings of orchard fruits, small fruits, field, garden, and hothouse crops, and cereal and forage crops. Suggestions are given for their control, based upon cultural methods and the application of fungicides.

Peridermium acicolum the æcidial stage of Coleosporium solidaginis, G. P. CLINTON (*Abs. in Science, n. ser., 25 (1907), No. 634, pp. 289, 290*).—An abstract is given of a paper by the author in which it is stated that *Peridermium acicolum* was found to be abundant on *Pinus rigida* in Connecticut during the spring of 1906. From observations and infection experiments the author has determined that this fungus is the æcidial stage of *Coleosporium solidaginis*, which is common throughout the United States on golden rod and asters.

Ascigerous forms of Glœosporium and Colletotrichum, C. L. SHEAR and ANNA K. WOOD (*Abs. in Science, n. ser., 25 (1907), No. 634, p. 291*).—The authors report having studied forms of these fungi from the grape, apple, cranberry, rubber plant, honey locust, gingko, cotton, and beans. The ascigerous form on the apple had been grown before, but, so far as known, on none of the other species had these forms been produced. So far as could be determined there were no morphological characters which separated the different forms, and for the present they are to be regarded as varieties of a single species. The ascigerous form has been found under natural conditions in only two cases, on the apple and on the rubber plant.

The use of the seed plat in the prevention of diseases in wheat, E. M. FREEMAN (*Amer. Breeders' Assoc. Proc., 2 (1906), pp. 49–53*).—The author discusses smut and rusts as the most important of the diseases of wheat and calls attention to the fact that seed treatment is more or less efficient for the prevention of smut, but that for the prevention of rust the selection of resistant varieties must be relied upon.

In order to combat these diseases it is suggested that 3 plats of wheat be maintained, (1) the seed plat, (2) the increase plat, and (3) the general farm crop. In seeding the first plat the seed should be thoroughly treated for the prevention of smut, and before the time for harvesting all smutted plants should be destroyed. If persisted in for a time this will result in a crop wholly free from smut.

To secure freedom from rust it will be necessary to conduct a systematic and rigid selection of disease resistant individuals.

By following out the author's suggestions it is claimed that it will be possible to secure an improvement in yield, earliness, etc., the prevention of the spread of weed seeds, the prevention of loose smut and bunt, and improvement in rust resistance.

Anatomical physiological study on the influence of environment and excessive fertilization upon the diminished or lost resistance to brusone of bertone rice, R. FARNETI (*Riv. Patol. Veg., 2 (1906), Nos. 1, pp. 1–11; 2–3, pp. 17–42*).—It is claimed that in 1828 when bertone rice was introduced into Italy it was of lower growth than at present, with a slender more rigid stem, with smaller heads, and with more abundant root hairs. At first it was considered as being almost if not absolutely immune to brusone. During the past 70 years it has gradually lost its resisting power to this disease, the mechanical tissues have become reduced in relative proportion, and all the other tissues have become softer. A study of the effect of environment and the excessive use of fertilizers indicates that these agents have not greatly influenced the epidermis but have increased the cavity in the stems and therefore weakened the plant to a greater or less extent.

A detailed account is given of the differences in anatomical features of this variety of rice in so far as comparisons can be made between former conditions and those that prevail at the present time. It is believed that the loss of resistance to brusone is a phenomenon which accompanied the exaggerated variation in the plant in recent years and is due to the action of fertilizers rather than to climate and other features of environment.

A number of infection experiments were carried on with a commonly recognized species of Piricularia and Helminthosporium. The brown spots characteristic of infection from these fungi are described. The author concludes as a result of his study that *Piricularia grisea*, *P. oryzæ*, *Helminthosporium oryzæ*, and *H. turcicum* are different names of the same species for which the name *Piricularia oryzæ* is preferred.

In combating brusone sulphate of copper may be used at the rate of one-half part to 100 of water. Some browning of the leaves and glumes is produced, but where this treatment is adopted or Bordeaux mixture is used at the same rate as copper sulphate, the total weight of the crop is not appreciably diminished.

A bacterial disease of cherry trees, R. ADERHOLD and W. RUHLAND (*Arb. K. Biol. Anst. Land u. Forstw., 5 (1907), No. 6, pp. 293–340, pl. 1, figs. 12*).—In continuation of previous studies (E. S. R., 17, p. 1165), the authors give further accounts of their investigations on a bacterial disease of cherry trees that has become quite destructive in parts of Germany.

Bacillus spongiosus, the organism suspected as being the cause of this disease, has been repeatedly isolated, and inoculation experiments show that there can be no doubt that it is actively parasitic. Other organisms, particularly various species of fungi, appear associated with this disease, but they are considered as of secondary importance.

After giving a technical description of *B. spongiosus*, the authors describe their inoculation experiments in considerable detail. In their experiments they frequently found other species of bacteria, one of which seems quite constant, but is believed to be saprophytic. This species seems to be undescribed, and the name *B. irritans* is given it.

In the previous account of this disease attention was called to a somewhat similar disease on apples and plums. Subsequent investigations of bacterial diseases of plum, prune, and apple trees showed that, while the organisms resemble those causing the cherry tree disease, the bacteria are not identical. Experiments comparing *B. spongiosus* with *B. amylovorus*, the cause of the pear blight, showed their nonidentity.

The authors state that the bacteria causing the cherry tree disease are undoubtedly conveyed from tree to tree by insects and possibly to some extent by winds and rain. In attempting to combat the disease all means possible should be adopted to prevent insect visits. All infected parts of the trees should be cut off and burned and the wounds disinfected.

The paper concludes with a description of the associated species, *B. irritans*, which is called a common saprophytic accompaniment of *B. spongiosus*. A brief list of the literature relating to bacterial diseases of fruit trees is given.

Takeall in wheat (*Jour. Dept. Agr. So. Aust., 10 (1906), No. 5, pp. 280–283*).—A description is given of a disease of wheat, due to *Ophiobolus graminis*, reported as being present in practically every wheat district of South Australia, and in some instances diminishing the yield fully 30 per cent.

There seems to be a difference in susceptibility of different varieties of wheat to this fungus. There is very little knowledge regarding preventive measures

to be taken, but the application of iron sulphate at the rate of 70 lbs. per acre, burning over infested areas, rotation with oats or other plants which do not seem to be subject to the disease, and allowing the land to lie fallow for a season or longer have been recommended. In view of the differences in susceptibility, the author thinks that there is more prospect of combating the trouble by the selection of resistant varieties.

In addition to wheat, the fungus is known to attack barley grass, wheat grasses, and other species of grass.

A potato leaf blotch fungus new to America, L. R. JONES (*Abs. in Science, n. ser., 25 (1907), No. 634, pp. 291, 292*).—In this abstract, *Cercospora concors* is reported as occurring in 3 well separated stations in Vermont during 3 different seasons, the first being in 1902. In every case the fungus has been found in old gardens, and indications are that it is a well-established parasite on the cultivated potato and is probably widely distributed in the longer settled regions of the northeastern parts of the United States and Canada.

The fungus attacks are confined to the leaves, where it develops concurrently with the early and late blight fungi, to which it bears so close a resemblance in appearance that it has probably been overlooked heretofore. It is believed that spraying will hold it in check.

A detailed account of this new disease is promised in the report of the Vermont Station for 1906.

Some potato diseases, their cause and control, A. NELSON (*Wyoming Sta. Bul. 71, pp. 39, figs. 11*).—Descriptions are given of early and late blight or rot of potatoes, Rhizoctonia disease, which is widely distributed, and potato scab. For the prevention of these diseases, spraying with Bordeaux mixture is recommended for early and late blight, while soil and seed treatment and rotation of crops are suggested as remedies for the Rhizoctonia and scab.

The deep scab of beets, F. C. VON FABER (*Arb. K. Biol. Anst. Land u. Forstw., 5 (1907), No. 6, pp. 342–350, pl. 1*).—The author briefly reviews some of the literature relating to the deep scab of beets, paying particular attention to the publications of Bolley (E. S. R., 3, p. 619), Frank (E. S. R., 10, p. 170), and others, after which he describes the anatomical structure of deep scab and considers the cause of the disease. Attention is called to the statement of Bolley that the deep scab is due to a bacteroid fungus. By the usual means the author has separated the organism, cultivated it in various media, and carried out successful inoculation experiments with pure cultures. He was unable to identify the organism with any known species and has named it *Bacterium scabiegenum*, a technical description of which is given.

A study of disease resistance in watermelons, W. A. ORTON (*Abs. in Science, n. ser., 25 (1907), No. 634, p. 288*).—A brief account is given of results of work on the watermelon wilt (*Neocosmospora vasinfecta nivea*). In studying this fungus the resistance of more than 100 varieties of American and Russian melons was tested and none of them proved to be immune. A hybrid between the watermelon and the citron or stock melon has been obtained, which in the third generation is said to have good edible qualities and at the same time is quite resistant to the fungus.

The use of common salt for the prevention of gummosis of fruit trees, E. VAN HECKE (*Jour. Soc. Agr. Brabant et Hainaut, 52 (1907), No. 13, pp. 366, 367*).—The author cites the observations of H. De Greeff in Zealand and C. Heime in China, both of whom claim that peaches, apricots, and similar fruit trees do not suffer from gummosis when grown near the sea or in soils containing appreciable quantities of salt.

Following this suggestion, experiments were conducted in which trees receiving 1, 2, and 3 lbs. of salt each were compared with others receiving none. At

the end of the season it was found that the tree receiving 3 lbs. of salt did not suffer at all from gummosis and the ones receiving 1 and 2 lbs. but slightly, while the fourth tree was severely injured, lost most of its branches, and bore little fruit as the result of the disease. It is planned to continue these experiments on a large scale to determine the actual value of the treatment.

Pear leaf blight (*Natal Agr. Jour. and Min. Rec., 9 (1906), No. 12, pp. 1135–1137, figs. 4*).—An account is given of pear leaf blight due to *Entomosporium maculatum*, a fungus quite common in various parts of America and Europe, but which has only recently become very troublesome in South Africa. The effect of the fungus on the host plant is described and directions are given for spraying with Bordeaux mixture and ammoniacal copper carbonate solutions.

A new native host for pear blight, M. B. WAITE (*Abs. in Science, n. ser., 25 (1907), No. 634, pp. 286, 287*).—In connection with investigations carried on in California, the author reports having found that the pear blight organism (*Bacillus amylovorus*) attacks the California holly (*Heteromeles arbutifolia*). This adds another host plant to the list of those known to be subject to this disease.

Experiments on the control of black rot in Loire, L. ROUGIER (*Rev. Vit., 27 (1907), No. 694, pp. 369–372*).—After describing the meteorological conditions and the invasion of black rot in 1906, an account is given of experiments made during the year for the control of the disease.

The vineyards were divided into 3 parts, one of which received 5 applications of acid copper acetate solution, another the same number of applications of Bordeaux mixture, while the third was held as a check. The acid solution of copper acetate was formed by adding $\frac{1}{2}$ liter of acetic acid to 1 kg. of neutral copper acetate, and diluted with 100 liters of water. The Bordeaux mixture was composed of 2 kg. of copper sulphate and 1 of lime to 100 liters of water. The first application of the fungicide was made May 23 and the last July 24.

A careful examination was made of the foliage and grapes, and it was estimated that there was a loss of 1 per cent where the vines were treated with the copper acetate solution, 5 per cent where treated with Bordeaux mixture, and 40 per cent where no treatment was given.

Some fungi of cacao trees, C. SPEGAZZINI (*Rev. Facult. Agron. y Vet. La Plata, 2. ser., 2 (1906), No. 4–6, pp. 303–311, figs. 5*).—Technical descriptions are given of a number of fungi reported on cacao trees the presence of which is considered detrimental to the growth of the trees. The species described are *Anthostomella bahiensis*, *Clypeosphaeria ? theobromicola* n. sp., *Calospora ? bahiensis* n. sp., *Latendrea bahiensis* n. sp., and *Hysteriopsis brasiliensis* n. g. and n. sp.

Lecture on rubber diseases, E. E. GREEN and T. PETCH (*Peradeniya Manuals, 1906, No. 1, pp. 32–45*).—Descriptions are given of a number of the more conspicuous insect and fungus pests of rubber. Among the fungi reported are *Botryodiplodia elastica*, which occurs on the roots of Hevea rubber, and *Fomes semitostus*, which is quite destructive on the same species of rubber. This fungus occurs on the stumps of quite a number of trees, from which it spreads to the Hevea, and it is advised that all such stumps should be removed, as far as possible, prior to planting. A discussion on this subject follows the presentation of this paper.

A root disease of Hevea brasiliensis, T. PETCH (*Circs. and Agr. Jour. Roy. Bot. Gard. Ceylon, 3 (1906), No. 17, pp. 237–242, pls. 2*).—The author reports the occurrence in one district of Ceylon of the root disease of *Hevea brasiliensis*, which is caused by the fungus *Fomes semitostus*. This fungus attacks the roots, and frequently associated with it are white ants, but these are believed to be secondary to the presence of the fungus. There appears to be no prelim-

inary indication of the disease, its presence being noticed only when the trees are nearly dead, when they frequently break off at or just below the surface of the ground. When the trees are examined the mycelium of the fungus will be found present, and often the sporophores may be observed either on the recently destroyed trees or on stumps that have persisted in the soil.

As there does not seem to be any means for detecting the presence of the fungus on young trees before they are dead, all remedial measures must be directed to preventing further losses. It is suggested that the diseased roots and lower portions of the trunks should be dug out and burned and trenches dug around the infected areas to prevent the fungus spreading laterally.

A plant tumor of bacterial origin, E. F. SMITH and C. O. TOWNSEND (*Science, n. ser., 25 (1907), No. 643, pp. 671–673*).—For about 2 years the authors have been carrying on studies of a tumor or gall which occurs on the cultivated marguerite, or Paris daisy. From diseased material the authors have succeeded in isolating bacteria, carried them through cultures, and by means of inoculation experiments have produced galls on other plants.

In some of their experiments 100 per cent of the inoculations gave positive results, while check plants, punctured but not inoculated, healed normally and remained free from galls. In addition to the marguerite the bacteria were found to develop small tumors in a few weeks on the stems of tobacco, tomato, and potato plants and on the roots of the sugar beet. It was also found that galls closely resembling the young stages of crown gall were produced on the roots of peach trees by needle pricks introducing this organism. The preliminary experiments have not been carried sufficiently far to enable the authors to say positively that their organism is the cause of the destructive crown gall of the peach, but the indications seem to point that way.

The organism causing these tumors has been designated as *Bacterium tumefaciens* n. sp., and a technical characterization of it is given.

Ray blight, a new chrysanthemum disease, F. L. STEVENS (*Abs. in Science, n. ser., 25 (1907), No. 634, p. 291*).—In a brief abstract the author reports having received specimens of chrysanthemums affected by a blight in which the ray flowers of the head were conspicuously attacked. The fungus, which belongs to the genus *Ascochyta*, is apparently undescribed. It also occurs on the stems. It was repeatedly isolated by plate cultures, and inoculation experiments conducted showed no difficulty in producing typical cases of disease.

Copper fungicides, E. RABATE (*Jour. Agr. Prat., n. ser., 13 (1907), No. 11, pp. 331–334*).—The author discusses the relative efficiency of various fungicides, the comparative value of liquid and dry forms, and gives formulas for the preparation of many of the fungicides in common use, together with directions for testing their acidity, after which he discusses the proper quantities to be used, as shown by observations regarding efficiency, cost of material, difficulty of application, etc.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Experimental zoology, T. H. MORGAN (*New York and London: The Macmillan Co., 1907, pp. XII+454, pls. 2, figs. 26*).—Attention is called to the fact that the vast majority of zoologists have been and still are doing observational and descriptive work. The author believes that in point of development zoology is far behind chemistry and physics. This is believed to be largely due to the small amount of experimental work which has been carried on by zoologists. The advantages of the experimental method as applied to zoology

are set forth with numerous illustrations of the results obtained, and the experimental work thus far carried on in various fields of zoology is summarized in such a way as to show the present standing of this phase of zoology and the necessity of further work of the same character.

Birds and fruit growers, W. E. BEAR (*Jour. Bd. Agr. [London], 13 (1907), No. 11, pp. 665–671*).—The value of legislation in protecting beneficial birds is set forth. It is believed that reliable information should be obtained from fruit growers regarding those species of birds which are beneficial and those which cause most damage to fruit. Mention is made of certain species which are the chief offenders along this line.

Insects; their organization, development, habits, and economic relations, A. BERLÉSE (*Gli Insetti loro Organizzazione, Sviluppo, Abitudini e Rapporti Coll'uomo. Milan: Soc. Ed. Libraria, 1906, vol. 1, pp. 584, pls. 6, figs. 697*).—In this first volume of the author's comprehensive work on insects attention is given to a brief history of entomology, the variation in the size of insects, the general plan of their anatomical organization, embryology, general morphology, and a detailed discussion of the various anatomical features of the different systems of tissues.

Insects of the garden, A. F. CONRADI (*Texas Sta. Bul. 89, pp. 52, figs. 44*).—Numerous requests are received by the station for information on garden insects, and the present bulletin is prepared to answer these inquiries. The more important garden insects are described, with notes on their life history and recommendations regarding methods of treatment.

C. E. Sanborn discusses the melon aphis and other related insects, with notes on remedies. For combating the melon aphis considerable reliance may be placed in the use of rape as a trap crop. Other methods are suggested, particularly fumigation and the encouragement of the insect enemies of this pest.

How insects are distributed, L. CAESAR (*Canad. Ent., 39 (1907), No. 3, pp. 85–90*).—Attention is called to the unusual opportunities which insects have in modern times for becoming distributed as a result of extensive commercial operations.

Fifth annual report of the chief inspector, A. F. BURGESS (*Ohio Dept. Agr., Div. Nursery and Orchard Insp. Rpt. 1906, pp. 51*).—A brief historical statement is given of the conception and operation of the present nursery laws of Ohio, with mention of the defects and strong points. Statistics are also presented showing the extent of fumigation and other treatment applied by the inspector during the year, together with a list of the more important fruit pests and of the nurserymen of the State.

Western slope fruit investigation, 1906. Report of the field entomologist, E. P. TAYLOR (*Colorado Sta. Bul. 119, pp. 16*).—During the season of 1906 attention was directed chiefly to methods of controlling the codling moth. Little variation was observed in the habit of the moth in the different orchards. It appears that about 60 per cent of the first brood enter the apples at the calyx. The second application of the insecticide must be made early enough to coat the surface of the small apple before the larvæ attempt to enter through the side of the fruit. There are but 2 generations of the insect, and it is believed that 2 sprayings should be effective against the first brood, rendering the second brood of little importance.

The first application of arsenicals was made about the middle of May, the second about the first of June. If desirable, other applications may be given at the first of July, the middle of July, and the first of August.

Notes are also given on the peach-twig borer, apple aphis, woolly aphis, and

other insect pests. The buds of apple and pear trees were injured to some extent by *Myochrous squamosus*.

Insects of German East Africa, II. P. BERENSBERG (*Natal Agr. Jour. and Min. Rec., 10 (1907), No. 1, pp. 50–55*).—A brief account of locusts, cotton insects, and the pests of castor-oil beans.

Report on the orchards and fruit plantations of Worcestershire, F. V. THEOBALD (*Worcester: Worcestershire Ed. Com., 1906, pp. 30*).—Notes are presented on the chief insect and fungus diseases observed in various orchards in different districts of Worcestershire. A list of 43 insects and 10 fungus diseases is given as found in the trips of inspection. Particular attention is devoted to the woolly aphis, green aphis, apple psylla, shot-hole fungus, etc. Insecticide treatment is recommended for apple psylla, woolly aphis, oyster-shell bark-louse, *Hyalopterus pruni*, *Aphis pruni*, etc.

Some miscellaneous results of the work of the Bureau of Entomology, IX. The Mexican conchuela in western Texas in 1905, A. W. MORRILL (*U. S. Dept. Agr., Bur. Ent. Bul. 64, pt. 1, pp. 1–14, pl. 1, figs. 2*).—*Pentatoma ligata* was reported as causing much damage to alfalfa, milo maize, cotton, and a number of other crops Some injury was also observed on peaches and grapes. The life history and habits of this insect are discussed, with notes on its natural enemies, both parasitic and predaceous.

Where this bug occurs in large numbers it is inadvisable to attempt to ripen a crop of alfalfa seed during July and August. The only satisfactory method for combating this pest is by means of hand nets and various forms of jarring apparatus according to the crop attacked.

Some miscellaneous results of the work of the Bureau of Entomology, IX. Notes on the economic importance of sowbugs, W. D. PIERCE (*U. S. Dept. Agr., Bur. Ent. Bul. 64, pt. 2, pp. 15–22, pl. 1*).—Particular attention is given to a discussion of the life history and habits of *Armadillidium vulgare*, which, for several years, has been reported as causing injury to various crops in Texas. This species of sowbug attacks cotton, palmetto, cucumbers, hot-house vegetation, and other plants, but will also eat decayed vegetation and the eggs of cattle ticks.

It may most conveniently be combated by the use of poisonous baits, especially potato or bread poisoned with arsenicals and placed in locations where the sow-bugs commonly congregate. Buildings may be freed of the pest by the use of carbon bisulphid.

An account is also given of the life history and habits of *Porcellio lævis* and *Metoponorthus pruinosus*.

Some miscellaneous results of the work of the Bureau of Entomology, IX. Notes on "punkies," F. C. PRATT (*U. S. Dept. Agr., Bur. Ent. Bul. 64, pt. 3, pp. 23–28, figs. 4*).—Observations were made on *Ceratopogon guttipennis* in Virginia. This gnat causes great annoyance to man and animals in localities where it occurs in large numbers. A detailed description is given of the insect in its various stages. The author also discusses other related species of this same genus.

A contribution to our knowledge of the Thysanoptera of California, D. MOULTON (*U. S. Dept. Agr., Bur. Ent. Bul. 12, pt. 3, tech. ser., pp. VI+39–68, pls. 6*).—In presenting an account of the Thysanoptera of California the author has found it necessary to erect a new genus Orothrips, and the genus Megalothrips is first recognized as having representatives in this country. Thrips attack a large variety of plants sometimes causing considerable injury. The attack of the pear thrips was the immediate occasion of the investigation reported in this paper.

A key is presented for the identification of families, genera, and species of this group found in California, and descriptions are given of all species recognized in the State.

Papers on the cotton boll weevil and related and associated insects. The cotton stalk-borer, A. C. MORGAN (*U. S. Dept. Agr., Bur. Ent. Bul. 63, pt. 7, pp. 63–66, pl. 1*).—Notes are given on the distribution, food plants, life history, natural enemies, and means of controlling *Ataxia crypta*. This insect feeds upon sunflower, cocklebur, figs, and various other plants, as well as cotton, but seldom causes serious injury. In one instance about 20 per cent of the stalks in a field of cotton was attacked. The remedy suggested is that of destroying the infested stalks early in the fall.

Papers on the cotton boll weevil and related and associated insects. Notes on the pepper weevil, F. C. PRATT (*U. S. Dept. Agr., Bur. Ent. Bul. 63, pt. 5, pp. 55–58, pl. 1, fig. 1*).—*Anthonomus æneotinctus* caused great injury to nearly all varieties of peppers in the region of San Antonio, Texas, but later the pest practically disappeared in some of the worst infested districts. This insect was apparently introduced from Mexico within recent years. The infested pepper pods show a slight proliferation of tissue, which assists in checking the work of the larva, but in cases of bad infestation it is necessary to collect and destroy fallen pepper pods or bury them by cultivation.

Enemies of rice (*Bul. Écon. Indo-Chine, n. ser., 9 (1906), No. 59, pp. 1164–1173, figs. 20*).—Special attention is given to two moths (*Cnaphalocrocis medinalis* and *Diatræa sacchari*). These pests cause serious damage to rice throughout Indo-China and can not be readily controlled by the methods which have thus far been devised. It is impossible to use irrigation as a means of control late enough to be effective against the insects without injuring the rice. The use of lantern traps has not produced very satisfactory results. The author therefore recommends the collection and destruction of all infested stools of rice at the time when the caterpillars are located at the base of the stems.

Experiments with Calandra oryzæ, B. WAHL (*Ztschr. Landw. Versuchw. Österr., 10 (1907), No. 2, pp. 57–70*).—A series of experiments was carried out to determine the food requirements of the rice weevil. It appears that this pest will feed upon corn, wheat, rye, barley, and rice, as well as a number of milling products, bread made from them, and macaroni. It does not breed, however, except in the 5 varieties of grains mentioned. In preventing its spread, it is desirable to keep close watch for infested grain and to apply suitable treatment at once.

Insect pests and diseases of sugar beets in 1906, O. FALLADA (*Separate from Österr. Ungar. Ztschr. Zuckerindus. u. Landw., 1907, No. 1, pp. 8*).—During the year under report the chief insect pests of sugar beets were wireworms, cockchafers, species of Cleonus and Haltica, cutworms, and plant lice. Brief notes are given on the habits of these pests. Short accounts are also presented of nematode worms, bacteriosis, scab, root rot, leaf yellows, leaf spot, and other fungus diseases.

Lita ocelletella and its injury to sugar beets in 1906, P. MARCHAL (*Sucr. Indig. et Colon., 69 (1907), No. 10, pp. 259–263*).—This insect in the larval form tunnels in the petioles of the leaves and in the outer portion of the sugar beets, particularly at the crown. In this way a great amount of damage is done. In preventing the ravages of this pest, it is recommended that crowns with leaves should be removed from the infected beets and used for feeding or ensiling in order to destroy the insects. In badly infested regions, it may also be necessary to adopt a system of crop rotation.

The cabbage maggot and other injurious insects of 1906, F. L. Washburn (*Minnesota Sta. Bul. 100, pp. 87, pls. 7, figs. 57*).—The material contained in this bulletin has already been noted from another source (E. S. R., 18, p. 749).

The oriental moth, a recent importation, H. T. Fernald (*Massachusetts Sta. Bul. 114, pp. 14, pl. 1, fig. 1*).—Early in 1906 cocoons were found on several kinds of fruit trees in Dorchester, Massachusetts, which subsequently proved to be *Cnidocampa flavescens*. This insect was most abundant near a locality where a Japanese nursery had previously been maintained and has become distributed to a distance of 2 miles in one direction and nearly 1½ miles in the other. The pest occurs on Norway maple, as well as other kinds of maple, and also on pear, apple, cherry, and crab-apple trees, and various species of forest trees. As many as 100 cocoons have been found on a single tree.

The oriental moth was apparently introduced before 1900. There is one brood annually, and the moths appear in June and July. The insect is described in all its stages. It has a wide distribution in the Orient and could probably thrive in almost any part of the United States. It is still doubtful whether it will prove a serious pest.

Preliminary report on cranberry insects, H. J. Franklin (*Massachusetts Sta. Bul. 115, pp. 15*).—A careful study was made of the remedies best adapted for controlling the chief insect enemies of the cranberry.

For the cranberry fruit worm on bogs which have an abundant water supply the author recommends flooding immediately after picking and drawing off the winter flowage early in April. On bogs with a limited water supply it is recommended that the winter flowage be turned on as soon as possible after the cranberry foliage has ripened. Arsenate of lead must be used as a spray on bogs which do not admit of flooding with water in winter.

In treating the fireworm on bogs with a good water supply, the winter flowage may be drawn off about the middle of April and the worms, which normally hatch after this period, may be destroyed by spraying with arsenate of lead.

If the false army worm appears in large numbers, it is desirable to reflow the cranberry bogs for 24 to 36 hours soon after May 15. This may be repeated if necessary. Dry bogs should be sprayed with arsenate of lead early in May.

The yellowhead cranberry worm may be controlled by holding on the winter flowage until after May 20 or by spraying dry bogs with arsenate of lead about May 15 and July 4.

A brief account is also given of methods of treatment for the cranberry girdler and spittle insects.

Poisoned bait for the fruit fly, T. F. Dreyer (*Agr. Jour. Cape Good Hope, 30 (1907), No. 2, pp. 192–194*).—A formula has already been suggested by Berlese for the preparation of a poisoned bait for killing the fruit fly, this bait consisting of 31 per cent of honey, 65 per cent of molasses, 2 per cent of glycerin, and 2 per cent of arsenite of potash. While it is believed that this formula would be of service in South Africa, another is suggested calling for 1 lb. of arsenate of lead and 5 gal. of sirup in 25 gal. of water.

Treatment for the olive fly, G. Battanchon (*Prog. Agr. et Vit. (Ed. l'Est), 28 (1907), No. 9, pp. 264–266*).—Arsenical treatments are admitted to have given good results in the treatment of the olive fly, but the author seems to recognize the prejudice against the use of arsenic on olives, and suggests that the immediate collection of all infested olives which fall from trees and the disinfection of storehouses where olives are kept might yield satisfactory results.

A viviparous fly with larvæ sometimes parasitic and sometimes vegetarian, J. K. d'Herculais (*Compt. Rend. Acad. Sci. [Paris], 144 (1907), No.

7, pp. 390–393).—In Algeria the larvæ of a fly had already been observed as a parasite on grasshoppers and referred to the species *Anthomyia cana*. The author observed another species of this genus, which is believed to be *A. cilicrura*, as a parasite on *Schistocerca americana* in the Argentine Republic. It is believed that this species has a wide distribution.

The apple and pear mites, P. J. Parrott, H. E. Hodgkiss, and W. J. Schoene (*New York State Sta. Bul. 283, pp. 281–318, pls. 10*).—In a study of the mites on apple and pear leaves, 5 species have been recognized: *Eriophyes malifoliæ*, *E. pyri*, *E. pyri variolata*, *Phyllocoptes schlechtendali*, and *Epitrimerus pyri*. *Eriophyes pyri*, commonly known as the leaf-blister mite, is the most abundant and the most injurious species. The structure, habits, and systematic position of these pests are discussed and a list is given of all American species of the family with their host plants and an analytical table for their identification.

Particular attention is given to *E. pyri*, which produces the well-known blister spots on the leaves of pear and apple trees. On apple trees the blisters may have a reddish tinge, but usually are less brilliant. The mites injure the fruits and fruit stems as well as the leaves, and have been found on 250 varieties of apples. After a little experience the injuries caused by mites may be readily distinguished from those due to spraying or to the apple rust. A parasitic mite was found preying upon the blister mite and is described as a new species under the name *Seius pomi*.

In experiments on apple trees a comparison was made between kerosene oil, miscible oil, kerosene emulsion, whale-oil soap, and the sulphur washes, the latter being prepared according to various formulas. On account of its harmlessness, cheapness, and efficiency, kerosene emulsion diluted with 5 parts of water and applied during the dormant season is recommended as the most practical remedy for the treatment of apple orchards infested with the blister mite. In pear orchards this pest may be controlled by proper pruning and by spraying with kerosene emulsion in the fall or spring.

The blister-mite and its allies, F. H. Hall et al. (*New York State Sta. Bul. 283, popular ed., pp. 10, figs. 6*).—A popular summary of the above bulletin.

The aphides affecting the apple, A. L. Quaintance (*U. S. Dept. Agr., Bur. Ent. Circ. 81, pp. 10, figs. 8*).—The aphides which are known to attack apple trees in the United States are *Schizoneura lanigera*, *Siphocoryne avenæ*, *Aphis mali*, and *Aphis malifoliæ*. The appearance, life history, and distribution of each of these pests are briefly discussed.

Little practical good has resulted from the use of strong lye water, whale-oil soap, kerosene, or crude petroleum in the control of apple aphides. Lime-sulphur wash gave good results in experiments by J. M. Aldrich. Formulas are given for the preparation of some of these insecticides.

The San José scale, A. F. Conradi (*Texas Sta. Bul. 87, pp. 11, figs. 4*).—A brief popular account of the appearance, life history, habits, and food plants of the San José scale and of the means of combating it. Directions are given for the preparation and application of lime-sulphur wash, whale-oil soap, kerosene, crude oil, and other insecticides. The lime-sulphur-salt wash, prepared according to the formula 15–15–15–50 and boiled for 45 minutes, gave excellent results. A lime-sulphur wash with the same proportion of lime and sulphur also proved very satisfactory.

The San José scale and experiments for its control, H. T. Fernald (*Massachusetts Sta. Bul. 116, pp. 22, fig. 1*).—Brief historical and biological notes are given on this pest. The author summarizes the results of spraying experiments to control the San José scale from 1902 to date. Some of this material is reproduced from Bulletin 86 of the station (E. S. R., 14, p. 1095).

The San José scale is at present found nearly everywhere in Massachusetts and feeds on 125 or more different kinds of plants. Its natural enemies do not keep it in check, and it is, therefore, necessary to cut down worthless, badly infested trees and burn them and to fumigate or spray other infested trees. In spraying the best results are obtained with lime-sulphur wash boiled from 40 minutes to 1 hour. Self-boiling lime-sulphur mixtures are less satisfactory. Likewise the K-L mixture has not given success. Proprietary insecticides for the San José scale either give poor results or are so expensive as to be out of the question.

How to control the San José scale and other orchard pests, J. Troop and C. G. Woodbury (*Indiana Sta. Bul. 118, pp. 395–423, figs. 14*).—Formulas are presented for the preparation of standard insecticides and fungicides, and a list is given of the more important of the insect diseases affecting the apple, cherry, gooseberry, grape, peach, pear, plum, raspberry, blackberry, and strawberry.

The present status of the San José scale in Indiana is outlined and the insect is described. Lime-sulphur wash is recommended as the best treatment for this pest.

How nurserymen may guard against San José scale, F. Sherman, Jr. (*N. C. Crop Pest Com. Circ. 11, pp. 11*).—Brief directions are given for the care of buds and cuttings, the spraying of nursery stock, and other lines of work to be taken up by nurserymen who wish to maintain premises free from San José scale.

The cottony maple scale in Illinois, S. A. Forbes (*Illinois Sta. Bul. 112, pp. 343–360, pls. 3, figs. 8*).—The cottony maple scale is seldom injurious to maple trees in natural forests, but causes great damage to trees planted along streets and roadsides for shade purposes. In Chicago it has been injurious continuously since 1886. It is particularly harmful to soft maple, but attacks also linden, box elder, elm, and a considerable variety of other trees. The life history and habits of this pest are discussed in some detail.

A brief summary is given of insecticide work thus far carried on by the author and others in its control. Kerosene emulsion was applied at a strength of 10 per cent in 1 experiment, and whale-oil soap at the rate of 1 lb. to 6 gal. of water was applied on a single tree. The insecticides were applied in July, and a comparison of the results showed that 33 per cent of the scales were killed by an application of kerosene emulsion at the beginning of the hatching period and 82 per cent by 2 applications at the middle and end of that period. Whale-oil soap was somewhat less effective.

The author concludes that for summer spraying a 10 per cent kerosene emulsion applied at the middle and end of the hatching period will give satisfactory results. The cost of this treatment for average trees is about 32 cts. each. In experiments carried on in Chicago the average cost for both materials and labor was 43 cts. per tree.

An application of a 19 or 20 per cent kerosene emulsion during the dormant season caused considerable injury to trees, some of which looked sickly in the spring and others died. The percentage of scales killed by the winter treatment ranged from 86 to 91.

The strawberry weevil in the South-Central States in 1905, A. W. Morrill (*U. S. Dept. Agr., Bur. Ent. Bul. 63, pt. 6, pp. 57–62*).—Since the strawberry weevil belongs to the same genus with the cotton-boll weevil it was thought desirable to ascertain whether there were any native parasites of the strawberry weevil in the cotton belt which might attack also the cotton-boll weevil. The study of the subject, as thus far conducted, has been confined largely to a determination of the prevalence and distribution of the strawberry

weevil in the Southern States, particularly in Texas, Louisiana, and Arkansas. In many localities the strawberry weevils were found to be comparatively rare, which is taken as indicating parasitism.

The poplar and willow borer (Cryptorhynchus lapathi), W. J. SCHOENE (*New York State Sta. Bul. 286, pp. 83–104, pls. 6*).—The imported poplar and willow borer has been known in the United States since 1882 and recently has been reported from Massachusetts to North Dakota. It attacks nearly all species of poplar, willows, and alders, and is a serious pest not only to shade trees but to the willow basket business. The insect is one-brooded and the adult beetles begin to appear about the middle of July.

In controlling this pest it is advisable to avoid making new plantations of poplar and willow near old ones. Badly infested trees or parts of trees should be cut and burned in June before the adult beetles appear. The same treatment should be given to all infested branches and trees broken by the wind. In nurseries it is believed that considerable benefit will follow the application of Bordeaux mixture containing an arsenical poison during the month of July. Preliminary experiments indicate that the beetles which feed upon plants treated in this way are killed within 3 or 4 days.

An enemy of poplars and willows, F. H. HALL (*New York State Sta. Bul. 286, popular ed., pp. 8, figs. 10*).—A popular summary of the above bulletin.

Insect injury to cacao beans, L. REH (*Ztschr. Wiss. Insektenbiol., 3 (1907), No. 1, pp. 21–25*).—Notes are given on the injury caused to cacao beans by the attacks of *Ephestia elutella* and *Araecerus fasciculatus*. Attention is called to the life history and habits of these insects and bibliographical references are added.

The spotted locust (Aularches miliaris), E. E. GREEN (*Circs. and Agr. Jour. Roy. Bot. Gard. Ceylon, 3 (1906), No. 16, pp. 227–236, pl. 1*).—In various parts of Ceylon this insect appears in large numbers and causes injury to various cultivated plants. Their favorite food seems to be *Erythrina lithosperma*, but they also attack various other trees. The pest is not observed to be doing any serious harm to tea, cacao, or rubber.

Notes on spraying and suggestions for combating crop pests, E. WALKER (*Arkansas Sta. Bul. 95, pp. 49–89*).—This bulletin contains practical directions for farmers, gardeners, and fruit growers for the preparation and application of the standard fungicides and insecticides. Notes are also given on spray pumps and their use, and a list is presented of the common field, garden, and fruit crops with the diseases and insect pests to which they are most subject and the remedies to be applied.

The breeding of bees, E. F. PHILLIPS (*Amer. Breeders' Assoc. Proc., 2 (1906), pp. 60–65*).—In recent years a considerable variety of bees have been introduced into this country, so that at present we have German, Italian, Cyprian, Carniolian, Holy Land, Tunisian, Banat, Caucasian, and Dalmatian races of bees. This gives opportunity to test the value of a number of hybrids, and some work along this line has already been done. Attention has been given in bee breeding to increasing the length of the tongue, to the capacity for honey collection, and to other points, including efforts to produce non-swarming bees, and to obtain more gentle races. The indiscriminate mixture of races does not give satisfactory results, but occasionally the first cross is better than either parent. It is recommended that bee raisers should produce their own queens.

Sericultural experiments at Shillong, B. C. BASU (*Agr. Jour. India, 2 (1907), No. 1, pp. 22–32*).—European one-brooded silkworms were introduced into India to test their adaptability to the climate. At Shillong the winter tem-

perature ranged from 38 to 60° F., but fell below 50° at some time during each day. If the temperature remains above 50° F. for 2 weeks or more during winter, the European silkworm is likely to begin development. This can not be checked, and the moths may, therefore, appear too early in the spring. Nothing of this sort happened at Shillong, and the race appears to be well adapted to that climate.

In a test of large and small leaf mulberries the size and weight of the cocoons were less when the large leaf variety was used for food.

The coloring matter of the silk of Saturnia yama-mai, C. GAUTIER (*Compt. Rend. Soc. Biol. [Paris], 62 (1907), No. 6, pp. 234–236*).—A study of the silk of this species shows that it is green and that under the microscope, after samples have been mounted in glycerin jelly, amorphous bodies are found which are not comparable to the crystals sometimes observed in large numbers in the normal cocoon.

FOODS—HUMAN NUTRITION.

The dynamics of living matter, J. LOEB (*New York: The Macmillan Co., 1906, pp. XII + 233, figs. 64*).—This work constitutes volume VIII of the Columbia University Biological Series and summarizes and treats of the author's extensive investigations in experimental biology. The lectures include discussions of the general chemistry of life phenomena, the general physical constitution of living matter, some physical manifestations of life, the rôle of electrolytes in the formation and preservation of living matter, the effects of heat and radiant energy upon living matter, heliotropism, facts concerning tropisms and related phenomena, fertilization, heredity, and the dynamics of regenerative processes.

Personal hygiene, M. LE BOSQUET (*Chicago: American School of Home Economics, 1907, pp. VIII + 232, figs. 34*).—The structure of the body, bones, muscles, nervous system, etc., the running of the body machine, the digestion of food, respiration, nutrition, temperature regulation, the care of the body machine, the hygiene of the nervous system, and of feeding, the care of the teeth, and related questions are taken up in this handbook of hygiene, which is designed primarily as a text-book for instruction by correspondence.

The volume as a whole constitutes a useful summary of data on this very important subject.

Food and hygiene, W. TIBBLES (*London: Rebman, Ltd., 1906, pp. XII + 672*).—The author has discussed food, air, and water with special reference to the needs of physicians and their patients. Composition and digestibility of food, food requirements at different ages and under different circumstances, dietetic treatment of diseases, and related questions are considered. An appendix gives dietary standards, factors for digestibility, and tables showing the composition and fuel value of foods.

The home economics movement, ISABEL BEVIER and SUSANNAH USHER (*Boston: Whitcomb & Barrows, 1906, pt. 1, pp. 67*).—In this historical account of the home economics movement in the United States, the authors have traced its growth in agricultural colleges, State universities, cooking schools, and public schools. The information summarized is of decided importance to teachers and students of home economics.

Early attempts were made to introduce home economic branches into schools of various kinds in this country, but the movement first took definite form about 1870. Among State institutions the 3 pioneers in the work were the Iowa State College, the Kansas Agricultural College, and the University of Illinois.

The rational feeding of infants from birth to 2 years, MICHEL and PERRET (*Rev. Hyg. et Méd. Infant., 5 (1906), No. 6, pp. 477–670, pls. 2, figs. 7*).—The authors have attempted to establish a scientific ration for the artificial feeding of infants between birth and 2 years of age. They have taken as a basis for their calculation a large amount of experimental and empirical data, which they summarize regarding the average weight of new-born infants, the gain in weight during different periods, the nature of the gain in terms of the composition of the body, the amount and character of material ingested and egested by infants breast fed and nourished on cow's milk diluted with water and sweetened with milk sugar, the amount of energy eliminated by infants per kilogram of body weight and per square meter of body surface, etc.

According to the calculations which are given, an infant weighing 8 kg. has a surface area of 3.696 square meters, and on the basis of 150 calories per square meter would require 554 calories of available energy for maintenance. The calculated amount of nitrogen necessary for a gain of 1 gm. in body weight is 0.02179 gm. A ration is proposed which can be modified to provide for the proper maintenance and growth, in accordance with the different weights of the infant at different periods. Observations of the effects of feeding a number of infants in accordance with the method proposed are reported.

The publication comprises a very comprehensive and valuable treatise of the rational feeding of infants.

Fruit recipes, R. M. BERRY (*New York: Doubleday, Page & Co., 1907, pp. XX+341, pl. 1, figs. 63*).—The composition and food value of fruits of temperate and tropical regions are discussed and information is summarized with reference to the origin, cultivation, and distribution of fruits and related topics. The bulk of the volume is given up to recipes for various fruit dishes and to a discussion of the use of fruits in various ways. The numerous illustrations refer particularly to the tropical and lesser known fruits. A detailed index adds to the value of the volume.

Concerning the vegetarian diet, R. STÄHELIN (*Corbl. Schweiz. Aerzte, 36 (1906), No. 13, Beilage, pp. 405–417; abs. in Zentbl. Physiol., 20 (1906), No. 17, p. 574*).—A comparison of vegetarian and meat diets from the standpoint of energy value and also with respect to their influence upon the nervous system, circulation of the blood, muscular work, renal activity, etc.

Studies of the composition of flesh upon different diets, M. MÜLLER (*Arch. Physiol. [Pflüger], 116 (1907), No. 3–4, pp. 207–228*).—The experiments which were made with dogs, in the author's opinion, showed that there is a specific nitrogenous substance characteristic of fattened animals which differs from muscle protein in that it shows a narrower ratio of nitrogen to carbon.

Fresh flesh of animals in good condition for slaughter when freed from visible fat is relatively rich in carbohydrates and shows a low water content, while its nitrogen content is little increased. The abundance of carbon is due to a deposit of fat in the cells, since the flesh freed from fat shows a carbon content less than normal. Well fattened flesh owes its quality very largely to the presence of the nitrogenous material characteristic of fattened flesh referred to above, and the deposition of fat in the tissue and the increased amount of dry matter are not, as is commonly supposed, the only differences between well fattened and unfattened meat.

In calculating nitrogen balances no serious error is introduced if it be assumed that the nitrogen is added in the form of muscle protein.

In the author's opinion, his experiments help to explain the retention of nitrogen so often observed on a diet rich in protein. He considers it possible that the increased carbon dioxid output which is noted on such a diet has to do

with this nitrogen "fattening substance," and implies a cleavage of protein in which a product rich in nitrogen is retained in the body cells while the remainder of the molecule must be eliminated.

The extractives of muscle. VII, Concerning certain carnitin compounds, R. KRIMBERG (*Ztschr. Physiol. Chem., 50 (1907), No. 3-4, pp. 361-373*).—The experimental data led the author to conclude that perhaps carnitin is a homologue of betain, and a graphic formula is suggested.

One hundred and one Mexican dishes, MAY E. SOUTHWORTH (*New York and San Francisco: Paul Elder & Co., 1906, pp. IV+86*).—Recipes are given for the preparation of a number of Mexican foods, including soups, fish, meat, vegetables, desserts, and a number of special dishes.

German cookery for the American home, ELLA OSWALD (*New York: Baker & Taylor Co., 1907, pp. XVI+236*).—Recipes for the preparation of soups, meat dishes, cakes, puddings, etc., are presented. According to the author the recipes selected include only those for which the ingredients may be easily procured. A detailed table of contents is given in both English and German.

The hay-box cooker (*Cornell Reading Course for Farmers' Wives, 5. ser., No. 23, p. 446*).—A brief description is given of the so-called hay-box cooker, in which tightly covered vessels containing boiling hot food are surrounded by nonconducting materials, so that the heat is retained and the food materials slowly cooked.

The fireless cooker (*Amer. Agr., 79 (1907), No. 1, p. 27*).—On the basis of personal experience a fireless cooker or hay box of home manufacture is described. It is stated that this device proved very satisfactory, lessening the labor of preparing food and effecting a considerable saving in labor and fuel.

Food adulteration in Texas, G. S. FRAPS (*Texas Sta. Bul. 91, pp. 24*).—The texts of the State pure-food law and the Federal law are given. Chemical preservatives, coloring matter, saccharin, and similar materials are described, and the results of the examination of a number of samples of sausage, olive oil, jelly and preserves, molasses and similar goods, vinegar, flavoring extracts, lard, canned goods, etc., are reported.

"Our examination of samples of food collected on the markets of Texas leads to the conclusion that there is a considerable amount of adulteration in certain classes of foods. Many of these adulterations are harmless, but are to be condemned, as they deceive the purchaser and provide him with an article other than what he supposes he is purchasing."

Bacteria of blown tins of preserved food (*Jour. Hyg. [Cambridge], 6 (1906), pp. 248-250; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 528, p. 699*).—The organisms found were intestinal bacteria and produced fermentation when reintroduced into sound cans. The fermented canned sardines, salmon, and beef did not produce toxic symptoms when fed to guinea pigs.

Tomato catsup, T. MACFARLANE (*Lab. Inland Rev. Dept. [Canada] Bul. 129, pp. 13*).—Examination of 49 samples of tomato catsup collected in Canada showed that 8 were unadulterated. In 23 of the remainder adulteration was doubtful, while 18 were adulterated. The range in total solids was considerable, according to the analyses, varying from 7.44 to 29.04 per cent. There were also decided variations in the constituents making up the solids.

Following one of the ordinary recipes, catsups were made from apple, turnip, and pumpkin pulp, and analyses of these goods are reported. In composition they did not differ materially from the tomato catsups.

Analyses of American malt vinegar, A. G. WOODMAN and G. P. SHINGLER, Jr. (*Technol. Quart., 19 (1906), No. 4, pp. 404-407*).—As shown by the analyses of 7 samples, American malt vinegars have a specific gravity of 1.0159, and

contain, on an average, 5.48 per cent total acetic acid, 2.46 per cent total solids, 0.24 per cent total ash, 0.11 per cent ash soluble in water, 0.09 per cent insoluble ash, 1.39 per cent reducing sugars (maltose) before inversion, 1.02 per cent reducing sugars after inversion, and 0.37 per cent protein. The polarization number is 2.38, the percentage of P_2O_5 in total solids, 2.29, and the ratio of soluble to insoluble P_2O_5, 1 : 0.890. Data are also reported regarding the alkalinity of the ash and other characteristics.

Common salt, T. MACFARLANE (*Lab. Inland Rev. Dept. [Canada] Bul. 128, pp. 13*).—The examination of a large number of samples of salt collected in the Canadian provinces showed that they contained from 93 to 98 per cent sodium chlorid. Six of the samples examined contained foreign substances soluble in water, apparently added to prevent the salt from caking. Under the Canadian law this addition, in the author's opinion, does not constitute adulteration. "Nevertheless it would seem to be necessary that these brands should each, on selling, be labelled as a mixture."

Concerning sour milk, J. R. TARCHANOW (*St. Petersburg, 1906; abs. in Chem. Ztg., 30 (1906), No. 97, Repert. No. 50, p. 430*).—A discussion of Metschnikow's theories regarding the therapeutic and hygienic value of sour milk and other foods containing lactic acid. A method of preparing sour milk in the household by the aid of lacto-bacilli is described by the author. In his opinion such an article is an important addition to the diet.

Condensed vegetable milk, T. KATAYAMA (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), pp. 113–115; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 530, II, p. 889*).—The condensed milk referred to is prepared by concentrating soy-bean milk in a vacuum after the addition of 150 gm. of sucrose and 1 gm. per liter of dipotassium phosphate. The product, according to the author, has considerable food value and can be used in preparing various dishes.

The presence of vegetable milk in ordinary condensed milk can be detected by the addition of sodium carbonate, which produces a yellow coloration, or by adding 2 volumes of water, a few drops of dilute sulphuric acid, and distilling when the characteristic odor of raw soy beans is noticeable.

Vegetable cheese from the proteid of the soy bean, T. KATAYAMA (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), pp. 117–119; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 530, II, p. 889*).—Vegetable cheese was prepared by mixing pressed tofu (made from soy beans), sodium chlorid, lactose, and Swiss cheese, the latter being added to introduce bacteria. In one experiment some casein was also added. The mixture was kept moist at 15° C. for 5 months. The resulting cheese was gray and free from holes, even when a considerable amount of lactose was used. It did not resemble Swiss cheese in flavor.

Cocoanut fat from a culinary standpoint (*Vyestnik Shirov. Promysch., 7 (1906), p. 103; abs. in Chem. Ztg., 30 (1906), No. 97, Repert. No. 50, pp. 430, 431*).—It is stated that the expressed fat of the cocoanut is used to a considerable extent in Russia under the name of "plantol." According to the data summarized, some 96 per cent of this fat is assimilated by man, a value which is only slightly less than that which has been obtained for butter. Cocoanut fat consists of about 84 per cent of triglycerids of myristic and lauric acid with 12 per cent of olein and small quantities of other fatty acids in similar bodies.

The principal results obtained in the scientific study of human nutrition, J. KÖNIG (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1906), No. 12, pp. 577–588*).—An historical account of the progress of investigations of special importance in connection with human nutrition, presented at the first Congress of Food and Human Nutrition, Paris, 1906.

Progress in nutrition, C. F. LANGWORTHY (*Lake Placid Conf. Home Econ. Proc., 8 (1906), pp. 60–64*).—A brief summary of the nutrition investigations

carried on during 1905–6, particularly those conducted under the auspices of the Office of Experiment Stations.

Nutritive requirements of the body, F. G. Benedict (*Lake Placid Conf. Home Econ. Proc., 8 (1906), pp. 64–76*).—A summary and discussion of the author's investigations which led to the conclusion that the commonly accepted dietary standards should not be appreciably lowered, especially as regards energy. A fuller account of the investigations has been previously noted (E. S. R., 18, p. 464).

Dietetic experiments at Yale University, I. Fisher (*Lake Placid Conf. Home Econ. Proc., 8 (1906), pp. 76–78*).—Nine healthy students were the subjects of an investigation covering 18 weeks, in which freedom of choice of food materials was given and very thorough mastication was insisted upon.

The author notes that the quantities of food eaten were less than usual, that the diet supplied less nutritive materials than are called for by the commonly accepted dietary standards, and that there was an especially marked diminution in the quantity of flesh foods desired. The men led sedentary lives and took practically no exercise. Gymnasium tests at the beginning and end of the experiments showed that their endurance was markedly increased. In the author's opinion this is to be attributed to the character of the food and the way in which it was eaten. Control experiments were not made. The paper is followed by a discussion.

Physiological economy in nutrition, I. Fisher (*Science, n. ser., 24 (1906), No. 620, pp. 631–633*).—The investigations briefly reported are noted above.

A respiration calorimeter, Letulle and Mlle. Pompilian (*Compt. Rend. Acad. Sci. [Paris], 143 (1906), No. 23, pp. 932, 933, dgm. 1*).—A respiration calorimeter of special construction is briefly described. It consists essentially of a chamber of glass and iron surrounded by 2 outer wooden walls. By means of the air spaces between these walls the temperature of the inside and outside of the respiration chamber is kept the same. The heat produced in the respiration chamber is taken up by a current of water passing through the calorimeter. It is stated that the regulation of the temperature of the calorimeter and the surrounding air spaces is automatic and that any temperature between 12 and 24° C. may be maintained in the chamber. According to results of electrical calibration tests the calorimeter will measure heat with an accuracy of 99.5 per cent.

As a respiration apparatus, the instrument described is of the closed-circuit type, the ventilating air current being maintained by means of a pump. Devices are provided for absorbing the water and carbon dioxid of the respired air and for replacing the oxygen withdrawn from the air.

The published description does not give details of the method of construction nor of the operation of the respiration calorimeter.

The respiration apparatus in the new physiological institute at Helsingfors, R. Tigerstedt (*Skand. Arch. Physiol., 18 (1906), No. 3–4, pp. 298–305*).—The respiration apparatus which has been recently constructed at Helsingfors is similar to the instrument at the Carolien Medical-Surgical Institute at Stockholm previously described (E. S. R., 8, p. 242). As shown by control experiments in which candles were burned in the respiration chamber, the instrument is sufficiently accurate for experimental purposes. The experimenters recognize that the experimental periods should not be of too short duration.

Concerning gastric juice secretion, B. Lönnqvist (*Skand. Arch. Physiol., 18 (1906), No. 3–4, pp. 194–262, dgms. 3*).—The numerous experiments reported were made with a dog which had been operated upon by the Pawlow method to produce a so-called small stomach.

The secretion of gastric juice, the author concludes, is brought about by psychic stimulation as well as by the action on the mucous membrane of the stomach and intestine of a number of chemical substances. In general, fat hindered the secretion of gastric juice. Water, alcohol, digestion products of protein, and meat extract caused an abundant secretion. Hydrochloric acid, having a strength of 0.1 to 0.5 per cent and normal gastric juice both affected the secretion very little. On the other hand, 0.5 per cent solutions of lactic acid and butyric acid produced an abundant secretion, and common salt and bicarbonate of soda caused secretions dependent upon the concentration of the solution used. Saliva and gall stimulated secretion in about the same degree as water. Gall, however, precipitated pepsin and so stopped digestion.

Natural digestion, it was found, takes place more rapidly and completely than artificial digestion, partly because the freshly secreted gastric juice comes into more intimate contact with the proteid material owing to stomach movements than is the case in vitro, and partly because the products of digestion are removed from the stomach soon after they are formed.

Other questions were also considered. An extended bibliography is appended to the report.

Investigations on the effect of common salt on the chlorin content of gastric juice, J. WOHLGEMUTH (*Arb. Path. Inst. Berlin, 1906, p. 561; abs. in Centbl. Med. Wiss., 1907, No. 1, p. 3*).—The experiments reported were made with a dog having a so-called Pawlow small stomach.

The chlorin content of the food was found to have a marked effect upon the stomach secretion dependent in considerable measure upon the character of the material fed. In general, it may be said that the normal stomach mucous membrane endeavors to keep the concentration of the gastric juice constrained within narrow limits and to so regulate the hydrochloric-acid content that it shall not become too high nor too low.

On the effect of bile upon the hydrolysis of esters by pancreatic juice, A. S. LOEVENHART and C. G. SOUDER (*Jour. Biol. Chem., 2 (1907), No. 5, pp. 415–425*).—Among the conclusions which were drawn from the artificial digestion experiments made with ox gall were the following:

"Bile salts, lecithin, and bile greatly accelerate the action of pancreatic juice on all of the esters studied, including olive oil.

"The optimum concentration for the bile salts when the lower esters are used is about 0.1 per cent, while for olive oil the optimum is from 2 to 4 per cent. In the latter concentration the bile salts greatly inhibit the action on triacetin, and the acceleration of the hydrolysis of ethyl butyrate is much less than when they are employed in greater dilution.

"Different specimens of juice and different experimental conditions altered greatly the degree of acceleration observed and the relative activity of the bile salts and lecithin.

"We advance no theory to account for the acceleration noted with these substances. While we believe that their action depends to a certain extent on their solvent action, it seems that in addition to this they accelerate the action of the enzym in some other way."

Synthesis of food protein in the liver, E. FREUND and G. TOEPFER (*Ztschr. Expt. Path. u. Ther., 3 (1906), No. 3, pp. 633–637*).—The investigations reported led to the conclusion that synthesis of protein takes place in the liver and that an abundant supply of blood through the portal vein is a necessary condition to its formation.

The relation of the kidneys to metabolism, F. A. Bainbridge and A. P. Beddard (*Proc. Roy. Soc. [London], 79 (1907), No. 528, pp. 75–83*).—It was found in experiments with small animals (cats) that the removal of three-fourths or more of the kidney weight was followed by a loss of appetite, wasting, and death within a few days or weeks. An increase output of nitrogen was not a constant occurrence and took place only when the animals had lost 22 per cent or more of their initial body weight.

"We conclude, therefore, that the kidneys have no direct influence upon nitrogenous metabolism, and that the increased output of nitrogen is simply the result of inanition, and is of the same nature as that observed in starving animals.

"We find that, after removal of a portion of one kidney, and also after subsequent removal of the opposite kidney, . . . [the animals experimented upon] are still able to pass a concentrated urine, and that the amount of the urine is not necessarily increased beyond the normal."

Concerning endogenous purin metabolism in man, V. O. Sivén (*Skand. Arch. Physiol., 18 (1906), No. 3–4, pp. 177–193*).—From a discussion of original experimental data and the work of other investigators, the author concludes that purin excretion is not determined by muscular work. In a number of tests purin excretion diminished during sleep, but if the work of the kidneys was increased by a heavy meal before retiring the purin excretion was increased.

The results as a whole are discussed with reference to various theories which have been advanced with reference to purin metabolism.

Concerning phosphorus metabolism, E. Koch (*St. Petersb. Med. Wchnschr., 1906, No. 36, pp. 400–402; abs. in Zentbl. Gesam. Physiol. u. Path. Stoffwechsels, n. ser., 1 (1906), No. 23, p. 723*).—The metabolism experiments reported furnish additional reasons for believing that the human body can not synthesize phosphorus compounds from protein-free phosphorus and inorganic phosphorus salts. It is perhaps possible, however, that inorganic phosphorus may be so utilized if organic phosphorus is excluded from the diet for a long time.

Equilibrium in metabolism, R. Ehrström (*Skand. Arch. Physiol., 18 (1906), No. 3–4, pp. 281–297, figs. 10*).—A theoretical discussion of the possibility of obtaining equilibrium with respect to nitrogen and other constituents. The author believes that in general there is a temporary retention of an element and that excretion then proceeds step by step until equilibrium is reached, provided the amount supplied remains constant.

The excretion of total nitrogen and amino acids in fasting, T. Brugsch and R. Hirsch (*Ztschr. Expt. Path. u. Ther., 3 (1906), No. 3, pp. 638–644*).—The experiments, which were made with a woman who was a professional faster, led to the following conclusions:

The nitrogen excretion for a fasting woman was 6.4 grams on an average in the 16-day test reported, which was 25 per cent lower than in the case of a man. The excretion of amino acids in urine was not increased nor could free glycocol be identified. Alanin is less thoroughly assimilated in fasting than under normal conditions. On the other hand, glycocol and leucin are well assimilated. A retention of nitrogen may be induced during fasting if amino acids (leucin and alanin) are fed, even without the addition of carbohydrates. On the other hand, glycocol is almost quantitatively converted into urea.

Acid formation in fasting, M. Bönniger and L. Mohr (*Ztschr. Expt. Path. u. Ther., 3 (1906), No. 3, pp. 675–687*).—The experimental data which were obtained with a fasting man led the authors to conclude that in all probability

oxybutyric acid is not formed in the body from leucin, or that at any rate if it be granted that theoretically leucin may yield isovaleric acid and the latter β-oxybutyric acid, such a process does not take place quantitatively in the body. By far the larger part of the acetone bodies excreted in the urine are derived from fat or fatty acids.

Third treatise on the effects of borax and boric acid on the human system, O. Liebreich (*London: J. & A. Churchill, 1906, pp. VIII+70, dgms. 27*).—In this article, which is a translation from the German, the author gives a critical review of the experiments on the effects of borax made under the auspices of this Department (E. S. R., 16, p. 684) and disagrees with the general conclusions which were reached. Earlier work has been previously reported (E. S. R., 11, p. 962).

The occurrence and identification of soluble proteid in the feces of adults, H. Schlössmann (*Ztschr. Klin. Med., 60 (1906), pp. 272–294; abs. in Zentbl. Gesam. Physiol. u. Path. Stoffwechsels, n. ser., 1 (1906), No. 23, p. 723*).—According to the author, the proteids precipitated from feces extract by acetic acid consist very largely of a complicated mixture of nucleo-proteids, with mucin under some circumstances. When large amounts of nuclein are taken in the food the feces of healthy adults do not contain an increased amount of nucleo-proteids, but with children such an increase is noted. The author's investigations also include the pathology of the subject.

The phosphorus content of feces fat, J. H. Long and W. A. Johnson (*Jour. Amer. Chem. Soc., 28 (1906), No. 10, pp. 1499–1503*).—Continuing earlier work (E. S. R., 18, p. 525) the phosphorus content of feces fat was studied. The fat content of 8 samples ranged from 8.6 per cent to 19.45 per cent on the dry-matter basis, and the P_2O_5 content of the fat from 0.2 per cent to 3.66 per cent.

"Extreme variations are shown in the percentage amounts of phosphoric acid recovered from the fat. As found before, these amounts are not increased by prolonged extraction."

As regards the source of the fats containing phosphorus the authors note that they may either represent unchanged substances from animal and vegetable foods or may represent products of metabolism within the body. The possibility of intestinal bacteria as a source of feces fat is also spoken of. The authors state that the investigations will be continued.

ANIMAL PRODUCTION.

Investigation of concentrated commercial feed stuffs as sold in Iowa, L. G. Michael (*Iowa Sta. Bul. 86, pp. 52*).—A large number of commercial feeding stuffs collected in Iowa were analyzed, including blood meal, tankage, and similar products, cotton-seed meal, linseed meal, wheat shorts or standard middlings, flour middlings, mixed wheat feed, low grade or red dog flour, hominy feed, corn and oat chop, corn-and-cob meal, corn meal, mixed alfalfa feeds, oat shorts, oat bran, oat flour, oat middlings, germ oil meal, pressed cracklings, germ meal, and gluten feed.

The samples of blood meal received during the year, the author states, ran below the percentage of protein guaranteed by the manufacturers, and the same was true of tankage.

"Meat meal, also guaranteed to contain 60 per cent protein, has averaged 2.13 per cent below that standard, one sample dropping as low as 52.47 per cent. Both products, stated to be free from stomach contents, have been found to contain undigested oat hulls or hair. Even as high as 4.4 per cent of silica (the basic constituent of sand) has been found in some samples.

"Of 13 samples of cotton-seed meal examined, only one was found to be 'prime' or up to the standard of 41.2 per cent protein set by the Cotton-seed Crushers' Association. The samples below grade are heavily loaded with cotton-seed hulls, which brings the protein content from 1 to 3.5 per cent below guarantee.

"The by-products of the wheat flour industry vary greatly, according to the process of milling. The quality of the output from a number of mills also fluctuates according to the other grains that are being ground whose inferior offal is run into the wheat by-products. Fluctuations may be due to other adulterating materials at hand.

"The average of our analyses of the mill feeds sold in Iowa show that most of these products are below the standards of those manufacturers who stamp their guarantees on the sacks containing their feeds. . . .

"It is a common practice to run scourings, corn hulls and offal, oat hulls and the hulls of weed seeds into the bran. The ground weed seeds and screenings have been run into the shorts. The effect that this practice has on the quality of the bran and shorts depends upon the extent of the adulteration. At a few mills where such admixtures were made, it was possible to get samples of pure shorts and bran direct from the duster, and other samples from the packer at which the sacking of these by-products for shipment was made. In some instances the differences in protein content were as great as two per cent.

"At some mills a system of 'padding' is carried on; that is, a sack is partially filled with shorts and the balance of the sack filled with bran. The whole is then sold at shorts prices. Sweepings from the floor are also used as padding.

"Corn and oat chop is one of the most widely used feeds in the State and one that shows the greatest variety of composition. Many local millers complain that they can not buy corn and oats and grind them at a profit in competition with the brands of this product that are shipped in from outside their vicinity. These 'shipped-in' chops invariably contain oat hulls, light oats, ground cob, and milling offal that render it possible for them to be offered at a figure the local grinder can not touch."

Condimental stock foods and tonics, L. G. MICHAEL and H. O. BUCKMAN (*Iowa Sta. Bul. 87, pp. 28, fig. 1*).—A large number of foods and tonics were examined and found to consist of common drugs usually with the addition of some inexpensive material as a filler.

According to the authors, there is a great sameness in these compounds "claimed to work wonders with stock. Common salt, sulphur, charcoal, pepper, and gentian predominate among the useful drugs while the non-medicinal fenugreek is omnipresent. Any particular stock food may have certain other ingredients predominating; but variations from these few drugs are of little importance medicinally. There are only a few over two score of different substances that can be used in such mixtures."

The cost of manufacturing stock foods and tonics "does not warrant the manufacturer charging for them such exorbitant prices. The great bulk (one-half or more) is made up of some common feeding-stuff that markets at not more than $1.50 per 100 lbs. (in one instance ground pine bark was used). About one-tenth is common salt and another one-tenth is charcoal. This leaves three-tenths to be made up of such simple drugs and remedies as anise, sulphur, ginger, red pepper, sassafras, and the like."

A formula for condition powders is quoted and modifications suggested which will enable the farmer to prepare a homemade stock food, if he wishes to use such material.

"A tablespoonful of such a mixture fed night and morning would not put his stock on the market in thirty days less time, neither would it double the flow of the milk of his dairy herd, nor would it prevent cholera in hogs, abortion in cattle, croup in chickens, nor glanders in horses. It is yet to be proved that any stock food or tonic will do this. The feeding of domestic animals is and always will be a matter of applied common sense and intelligence. But such a stock food would have the merit of being extremely inexpensive, besides having as much merit in other ways as any of its class."

From a summary of experiments on the effects of condimental stock foods on digestibility and related topics, it is evident, according to the authors, "that condimental stock foods and tonics, instead of producing the prodigious results claimed for them, have really little or no beneficial effects and may greatly increase the cost of beef, pork, and milk production."

The examination of cattle and poultry foods, J. B. LINDSEY (*Massachusetts Sta. Bul. 112, pp. 58*).—Under the provisions of the State feeding-stuff law analyses were made of a large number of samples of cotton-seed meal, linseed meal, gluten feed, dried distillers' grains, malt sprouts, dried brewers' grains, wheat middlings, wheat mixed feed, wheat feeds with admixtures, wheat bran, dairy feeds, molasses feeds, rye feeds, calf meal, corn meal, hominy meal, corn and oat feed, fortified starchy feeds, oat feed, miscellaneous starchy feeds, meat scraps, meat and bone meal, bone meal, granulated milk, poultry mash and meal, chick and scratching grains, and alfalfa and clover meals.

Some of the author's deductions follow: Most of the high-grade and medium cotton-seed meals were found to meet their protein guarantees and were of good color and taste. The new-process linseed meal contained rather less protein than was found in the two preceding years, though the price per ton was higher. The majority of the old process meals were of first grade. Four of the 19 samples were second quality, although the price asked for these was 29 cts. a ton in excess of that for first quality goods.

The author notes that many mills and large jobbers are placing a guarantee of composition upon their mill by-products. The importance of not running screenings, ground or unground, into these feeds is insisted upon. "It is believed that the addition of light oats, hulls, weed seeds, and the like will in the end work fully as much harm to the manufacturers as to the consumers."

The feeds classed as wheat feeds with admixtures were found to consist principally of bran and ground corn cobs in the proportion of about 3:1. "Our observations lead us to infer that these goods are frequently offered untagged, or sold for straight bran, the tags having been removed before delivery. We can not caution buyers too strongly to be on their guard against such deception."

As regards mixed dairy feeds, the author believes that while many of the proprietary mixtures found on sale should prove satisfactory as complete grain rations for dairy stock the dairyman can himself prepare as good or better rations for less money, and formulas for such mixed rations are given.

"The better grades of molasses feeds test rather higher in protein than formerly, are readily eaten, and can be safely fed as the entire grain ration if desired. At prevailing prices they do not furnish digestible matter as cheaply as it can be obtained from home-mixed rations, and as sources of digestible protein they are decidedly expensive. The writer can not from a standpoint of economy advocate these mixtures in place of those that can be made by the ordinary dairyman from cotton-seed meal, gluten feed, distillers' and brewers' dried grains, malt sprouts, flour middlings, corn and hominy meals."

Concerning the comparative value of red and white wheat for poultry feed,

the author states that one sort is as good as another, providing they are equally well developed. Alfalfa meal, he points out, is much superior to clover meal as a source of protein, and the tops of both plants are the best portion for poultry feeding. "Poultry men should grow their own clover, cutting and curing it when in the bud."

To facilitate the mixing of rations a table is given which shows the weight of a quart and the measure of a pound of a number of the more common proteid and starchy feeds.

The feed control in 1905–6, J. W. Carson and G. S. Fraps (*Texas Sta. Bul. 90, pp. 74*).—The text of the State feeding-stuff law is given and the results of examination of 1,626 samples are reported. These include corn chops, Kafir corn, corn bran, corn-and-cob meal, wheat bran, wheat shorts, wheat chops, cotton-seed meal, cotton-seed cake, cotton-seed serum, cotton-seed feed (cold processed cotton-seed meal and hulls), mixed feeds, rice bran, rice polish, rice hulls, chicken feed (cracked rice), milo maize, ground oats, alfalfa meal, mixed poultry feed, blood meal, meat meal and similar goods, bone for poultry, and tankage. A number of samples were found lower than guaranteed, but in general the feeding stuffs on the market were satisfactory. "There have, of course, been cases in which inferior or adulterated feeding stuffs were sold, but for the most part the feeding stuffs have been of excellent quality."

Commercial feeding stuffs, J. L. Hills and C. H. Jones (*Vermont Sta. Bul. 124, pp. 8*).—The following materials, cotton-seed meal and feed, linseed meal, gluten meal and feed, distillers' dried grains, molasses feed, hominy feed, oat feed, corn and oat feed, mixed feed and ground corn cobs, calf meal, meat and bone meal and poultry feed, were collected during the spring of 1906 and examined under the provisions of the State feeding-stuff law. Most of the materials entirely or very nearly met their guarantees.

As regards cotton-seed feeds, the authors call attention to the fact that their guaranteed protein content is practically one-half and their retail price five-sixths that of cotton-seed meal.

With the exception of 2 of the lower grade samples, all of the distillers' dried grains offered for sale were below the guarantee, as were also 4 of the 7 samples of molasses feeds. "These goods are relatively new on the Vermont feed markets, and are—speaking broadly—admixtures of waste molasses and sugars with sundry grain products and offals, or with beet pulp." With the exception of 1 brand, the 4 alfalfa feeds were equal to their guarantees. "These are also somewhat new in eastern markets. Cut or ground alfalfa hay—the whole plant in some cases, the more tender portions in others—form the basis, to which are sometimes added more or less of the approved forms of concentrates. The straight ground hay needs no guaranty."

"It should be clearly understood that guaranty maintenance, though desirable, is not the sole criterion by which a feed should be gaged. Many brands habitually contain less protein than their manufacturers claim for them, yet, notwithstanding, at ruling prices are far more economical and desirable purchases than are some feeds which regularly meet the low standards their makers set for them."

Commercial feeding stuffs, J. L. Hills and C. H. Jones (*Vermont Sta. Bul. 125, pp. 11–16*).—In carrying out the State feed-inspection work, examinations were made of a number of samples of cotton-seed meal, linseed meal, gluten feeds, distillers' dried grains, brewers' dried grains, molasses feeds, alfalfa feeds, hominy feed, oat feeds, corn and oat feeds, wheat offals, and provenders, collected in November, 1906. With the exception of the cotton-seed meal and the

distillers' dried grains the materials examined met or very nearly met their guarantees.

"It should not, of course, be inferred, because the present low grade of cotton-seed meal is deplored and the continued shortage of distillers' dried grains is lamented, that consumers should turn the cold shoulder on these goods. Notwithstanding their failures to meet guarantees, they are far better purchases than are most if not all of the lower graded goods whose promised protein contents are maintained."

Licensed commercial feeding stuffs, 1906, F. W. WOLL and G. A. OLSON (*Wisconsin Sta. Bul. 142, pp. 54*).—Under the provisions of the State feeding-stuff law analyses were made of 248 samples of licensed and unlicensed feeds, including cotton-seed meal, linseed meal, gluten feeds, corn feeds and similar goods, mixed corn and oat feeds, commercial and proprietary dairy and horse feeds, malt sprouts, blood meal, meat meal and similar goods, mixed poultry feeds, molasses feeds, rye sprouts, wheat bran, wheat middlings, molasses beet pulp, oats, ground oats, clipped oats, corn meal, damaged wheat, wheat screenings, barley screenings, barley feed, barley hulls, wet brewers' grains, and buckwheat bran.

According to the authors, considerable improvement has taken place in recent years in the character of the concentrated feeds sold in Wisconsin. The number of deficiencies in guaranteed composition of licensed feeds was smaller this year, and fewer mixed feeds of inferior grade were offered for sale than in the past.

"Farmers and dealers can, therefore, feel that the feed market in our State is in a better condition in regard to the quality of the feed offered for sale, and reputable dealers have less to fear from dishonest competition than ever before.

"Several unsuccessful attempts were made to sell goods of inferior grade during the year. So far as we have been able to ascertain, no serious adulterations of feeding stuffs have, however, been practiced during the year in this State. The admixture of undesirable materials, like screenings to flour-mill feeds, barley hulls to malt sprouts, or manufacture of refuse-feeds from poorly-cleaned seed, as in the case of flour or oil mills, have been met with, but no dangerous adulterations have been found as, for instance, with rice hulls, which were found in last year's inspections."

Stock food [corn silage for horses] (*Natal Agr. Jour. and Min. Rec., 9 (1906), No. 12, pp. 1123–1128*).—The value of different forage crops for winter feeding is spoken of.

The statement is made that corn silage has been satisfactorily used at the Mooi River Remount Depot as feed for horses. The daily ration of horses running in paddocks consisted of 4 lbs. of chopped corn silage, 2 lbs. of alfalfa or forage, a few pounds of crushed corn, and an ounce of salt. "From the first they liked the ensilage and did remarkably well on it. Many horses not doing well before showed improvement. The droppings were of a particularly healthy nature. The stabled horses also had a few pounds mixed with other food—even those working—at their midday feed, and did well on it."

The calculated and determined nutrients of rations, J. A. HUMMEL (*Minnesota Sta. Bul. 99, pp. 121–132*).—In discussing feeding problems it is customary to calculate digestible nutrients by the aid of standard factors. Digestion experiments with steers, undertaken at the station and not yet reported, gave the opportunity of comparing calculated and determined results.

The ration fed consisted of 14 lbs. of ground grain made up of corn meal, bran, oats, and oil cake 4:3:2:1 with 10 lbs. of timothy hay and corn fodder

ad libitum (usually 5 lbs.) in addition. In determining the nutritive value of the ration it was found that the composition of the ground feed agreed so closely with the composition, as shown by analyses, of the separate ingredients that it was evident the grain mixture could be considered as one food material in making calculations and computations.

The following table shows the average results of the 6 digestion trials as determined and as calculated by means of digestion coefficients used with both determined and average values for the composition of feeding stuffs:

Comparison of determined and calculated amounts of nutrients digested from same ration.

Method followed.	Dry matter.	Protein.	Fat.	Total carbohydrates.	Ash.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Results obtained by digestion experiments	63.82	7.26	2.64	52.53	1.17
Results calculated from actual analyses of feeding stuffs and average digestion coefficients	64.66	7.54	3.06	50.47	1.36
Results calculated from average figures for composition of feeding stuffs and digestion coefficients	65.69	7.62	2.97	53.84	....

"It will be observed there is a reasonably close agreement between the actual digestible nutrients of this ration . . . and the calculated digestible nutrients. These results show that for all practical purposes the tables of digestible nutrients, as recorded in standard works on feeding compiled from the average composition of American feeding stuffs and average digestion coefficients, are sufficiently accurate for the general calculation of rations. The difference between the actual and calculated nutrients, as found in this investigation, in which 6 steers of widely different types were used, was small, amounting in 1 day to less than $\frac{1}{4}$ lb. of dry matter and less than $\frac{1}{10}$ lb. per day of protein.

"In the case of the individual steers the digestibility of the protein ranged from 59.32 to 66.64 per cent and the carbohydrates from 76.08 to 82.08 per cent. It is to be noted that in a mixed ration, such as used in this investigation, only about two-thirds of the dry matter . . . a little less than two-thirds of the protein, and about three-quarters of the fat and carbohydrates of the food consumed were digested and utilized by the body. These results show that under the condition of the experiment in which a mixed ration was used from one-third to one-fourth of the nutrients were voided as indigestible matter in the feces."

In the author's opinion the results of the experiments emphasize the desirability of using coarse fodder which supplies a maximum amount of protein.

The energy value of the urine was determined to secure data for calculating the available energy of the ration. The nitrogen in the urine and the balance of income and outgo of this constituent were also determined.

"In this investigation an average of 63.92 per cent of the total energy of the ration measured in calories or heat units was available to the body. In the daily ration the food supplies 47,875 calories and 30,600 calories were available to the body. While this is apparently a large loss, it is a more economical use of the fuel value than a steam engine where only about 15 per cent of the energy is available."

Composition and digestibility of emmer, J. A. HUMMEL (*Minnesota Sta. Bul. 99, pp. 133-138*).—The digestibility of whole and ground emmer fed with alfalfa hay and of alfalfa hay alone was determined in experiments with sheep. The average results follow:

Average digestibility of emmer and alfalfa hay—Experiments with sheep.

Kind of feed.	Dry matter.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Whole emmer and alfalfa hay	78.97	80.62	66.46	91.41	60.86	37.02
Ground emmer and alfalfa hay	81.33	82.62	77.55	88.74	70.49	51.36
Alfalfa hay	54.83	68.81	15.75	69.05	41.31	24.41
Emmer alone (calculated)	93.99	86.73	92.38	96.56	83.60	53.23

As shown by the results, a ration of emmer and alfalfa hay when fed to sheep has a high digestibility, especially as regards protein and nitrogen-free extract. "There was a much more complete digestion of the ration of hay and grain than of the ration of hay alone." The results also show a high digestibility for emmer. "In localities where emmer can be grown successfully it will be found a valuable addition to the ration of growing or fattening cattle."

In connection with the digestion experiments the urine was collected and analyzed in order that the balance of income and outgo of nitrogen might be determined.

The heat-producing value of the crude fat of fodders and grains, H. SNYDER (*Minnesota Sta. Bul. 99, pp. 139, 140*).—In discussions of energy value ether extract is assumed to yield 9.5 calories per gram, which is the average value obtained when fat is burned in a bomb calorimeter. To ascertain whether this factor is accurate the heat of combustion of the ether extract of several kinds of coarse fodder was determined, the results being as follows: Corn fodder 8.047, corn silage 7.545, clover hay 8.036, and timothy hay 8.220 calories per gram.

"When the fats of wheat and barley were extracted and burned in the calorimeter they yielded 9.34 and 9.21 calories, respectively, indicating that with these cereals the ether extract has practically the same caloric value as pure fat."

It is evident that the figures for coarse fodder are from 11 to 20 per cent lower than the theoretical value and this difference is attributed to the presence of nonfatty material, such as chlorophyll, in the ether extract. To secure additional data regarding the proportion of such nonfatty bodies present determinations were made of the nitrogen content of ether extract and the following percentages were obtained: Clover hay 0.174, timothy hay 0.153, corn 0.062, oats 0.063, barley 0.047, and wheat 0.043 per cent.

"The nitrogenous matter in the ether extract from the grains was found to be much less than in that from the coarse fodders, as clover and timothy. In the case of wheat and barley, if all of the nitrogen of the ether extract is considered present as lecithin, there would be less than 8 per cent of this material.

"The heat of combustion of the ether extract of grains indicates that in the calculation of rations it may be regarded as having the same energy value as fat; in coarse fodders, however, the ether extract has an energy value of 11 to 20 per cent less than fat. . . .

"While the chlorophyll reduces the heat of combustion of the ether extract, there are compensating factors; its presence in the fodder is a desirable characteristic, for the color of the fodder is due to chlorophyll and is an index of quality. Feeders justly give preference to well-cured fodders of good color."

The digestibility of rye feed meal, O. KELLNER ET AL. (*Landw. Vers. Stat., 65 (1907), No. 5-6, pp. 466-470*).—In digestion experiments with sheep it was found that rye feed meal on an average had the following coefficients of digestibility: Dry matter, 92.7; protein, 75.9, and nitrogen-free extract, 96.8 per cent.

The facility of digestion of foods a factor in feeding, C. L. BEACH (*Connecticut Storrs Sta. Bul. 43, pp. 23*).—A series of tests is reported in which corn meal and mixed hay in turn were fed as a maintenance ration to 2 dry, farrow cows. The results of tests with milch cows, pigs, and calves are also quoted and discussed for purposes of comparison.

On an average 6.25 lbs. of corn meal containing 4.5 lbs. digestible nutrients was required for maintenance by the farrow cows as compared with 13.15 lbs. of hay containing 7.1 lbs. of digestible nutrients; that is, on an average 57 per cent more digestible nutrients was required for maintenance when derived from hay than from corn meal. "Less digestible nutrients from corn meal, therefore, were required for maintenance than from hay, because less energy of the feed was used in the work of digestion and assimilation." "An increase in the proportion of grain to roughage in a ration for milch cows [in tests which were quoted] tends to facilitate digestion, and is followed by increased production."

A similar explanation will account for the more rapid gain in the case of the pigs and calves fed the more easily digestible rations in the tests summarized. In general, according to the author, "the value of a feed depends upon its composition, digestibility, and ease or facility of digestion. The first two factors are considered in the formulation of rations. The third factor has only recently been recognized, and little definite knowledge in regard to it is at hand. In a general way it is recognized that milk is more easily digested than meal, concentrates than roughage, early than late cut hay, silage than corn stover, oat than rye straw. A pound of digestible matter, therefore, should be more valuable in the former than in the latter."

Investigations in the use of the bomb calorimeter, J. A. FRIES (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 94, pp. 39*).—The results of investigations like those carried on with the respiration calorimeter at the Pennsylvania Experiment Station in cooperation with the Bureau of Animal Industry depend for their value in large measure upon accurate determinations of the heats of combustion of feed, urine, and feces. Critical studies were therefore undertaken of the determination of such values and the factors which affect the accuracy of results and related questions.

The bomb calorimeter used is briefly described and the methods of operating it are outlined. Among the factors affecting accuracy of results which were investigated were the quality of the oxygen, the formation of nitric acid in the bomb during combustion, the oxidation of combined nitrogen to nitric acid, and incomplete combustion.

The experimental and analytical data reported led to the following conclusions: "There are many possibilities for error in the work with the bomb calorimeter. Undoubtedly many investigators in the past have worked with impure oxygen and never questioned its purity. In the light of our present experience it is questionable whether Stohmann himself, by the use of a heated copper tube, could have removed the last traces of combustible gases from his oxygen. The disappearance of nitric acid formed and its relation to the ash has not been taken into consideration, and it is only within a couple of

years that the thermometer lag has come to be applied in the calculations of the results.

"These overlooked or at times unknown difficulties . . . may be the cause of some of the disagreements of results as experienced by different investigators."

The author believes that "much work is yet needed in the different lines indicated before the method for determinations of heat of combustion by means of the bomb calorimeter can be called perfect."

Animal breeding in Europe, W. J. KENNEDY (*Amer. Breeders' Assoc. Proc., 2 (1906), pp. 135–140*).—The leading features which underlie the successful animal breeding in Europe, according to the author, are "a genuine liking for good animals, a keen judgment of animal form, a clear cut and well-defined aim or purpose, permanency of work, good judgment and care in the selection of sires, impartiality toward fads and fashions, the beneficial influences of government aid, the favorable climatic influences in certain districts, and the pecuniary advantages accruing from live-stock farming."

American work in breeding plants and animals, W. M. HAYS (*Amer. Breeders' Assoc. Proc., 2 (1906), pp. 155–167*).—As the author points out, the United States as a whole and the individual States are giving very broad recognition to breeding interests. The lines of work followed are concerned with the introduction of plants and animals, breeding experiments carried on by private individuals, cooperative work between public and private agencies, educational work in breeding, and research work in heredity and breeding. In all these lines except the second the National Government and the States take a prominent part.

Carcasses of beef and live-weight prices, W. DINSMORE (*Breeder's Gaz., 51 (1907), No. 8, p. 409, figs. 2*).—The commercial cuts into which a beef carcass is divided are illustrated and the proportion of high-priced and low-priced cuts discussed with reference to practical feeding.

"For years there has been, and there is now, a keen demand for cattle that will cut out heavy loin and rib cuts with a minimum per cent of those cuts that are less in demand. The heavy muscles on the back and loin, which give thickness to these parts, can not be developed by exercise, for they are used only in bending the back down or to one side; and if they could be so developed it would not be desirable, as it would but result in coarsening the fiber, thereby making them less tender. Feeding within practical reasonable limits has but little influence on the per cent of lean meat, and the only way in which we can increase the thickness of flesh element on these most-desired parts is by the selection of thick-fleshed sires and dams, by the utilization of every favorable variation in this direction."

Skim milk as a feeding stuff for calves, A. PIROCCHI (*Ann. Ist. Agr. [Milan], 6 (1901–5), pp. 123–189, figs. 2*).—Experimental studies are reported and data summarized regarding the feeding value for calves of skim milk alone and supplemented by different materials, including among others rice, ground malt, corn meal, linseed oil, peanut oil, sesame oil, oleomargarine, dried blood, eggs, and commercial calf feeds. Gain was most cheaply made with skim milk supplemented by oleomargarine, and was most expensive with whole milk.

A bibliography of skim milk as a feeding stuff is an important addition to the report. A briefer account of the experiment has already appeared (E. S. R., 17, p. 894).

The amount and fat content of the milk taken by sucking calves, SCHILLER-TIETZ (*Vrtljschr. Bayer. Landw. Rat., 11 (1906), No. 4, pp. 679–687*).—

From a summary of data the author concludes that the desire for milk with a high fat content expresses a physiological demand.

Fattening range lambs, B. E. CARMICHAEL (*Ohio Sta. Bul. 179, pp. 68–88, figs. 4*).—The relative value of cotton-seed meal, linseed meal, and a commercial stock feed as supplements to corn was studied with 4 lots of 40 wether lambs each, the test covering 103 days. In every case the grain ration was supplemented by clover, blue-grass, and alfalfa hay.

The daily gain on the corn ration was 0.298 lb. per head and on corn supplemented by other concentrated feed it ranged from 0.302 lb. on linseed meal to 0.312 lb. on a commercial stock feed. The cost of a pound of gain on the corn ration was 4.91 cts., on the ration with a commercial stock feed 4.80 cts., and on cotton-seed meal and linseed meal 5.14 and 5.31 cts., respectively. One of the lambs fed the commercial stock feed died during the test. When the lots were slaughtered and dressed the shrinkage ranged from 50.9 per cent with the cotton-seed meal lot to 53.5 per cent with the corn lot.

The manure from the 4 lots was collected and its value estimated, that obtained from the lots fed cotton-seed and linseed meal being the most valuable. "The extra cost of the rations, however, more than equaled the increased value of the manure."

As pointed out by the author, the lot fed the commercial stock feed made slightly greater gains at a lower cost than the other lots, and also shrank less in shipping and yielded a higher percentage of dressed weight than any of the lots except that fed the corn ration without additional concentrated feed. The author notes, however, that the differences in gains between the 3 lots receiving concentrated feed in addition to corn were so small that it can not be said that any of the rations possessed a decided superiority over the others. "It would not be surprising if the same rations should give opposite results in future trials, and it is safe for us to consider that the rations tested are of practically equal value pound per pound for use in lamb feeding under the conditions of this test."

Crossbred lambs, G. M. MCKEOWN (*Agr. Gaz. N. S. Wales, 18 (1907), No. 2, pp. 156–158, figs. 5*).—As regards the number of lambs born, average weight, etc., the best results were obtained with a Lincoln-Merino cross in lamb-breeding experiments at the Wagga Experimental Farm.

Swine, J. J. MORTON (*Orange River Colony Dept. Agr., Ann. Rpt., 2 (1905–6), pp. 54–62, pls. 2*).—Brief statements are made regarding the pigs kept at the Tweespruit Experimental Farm and a feeding test undertaken with reference to the production of bacon hogs is reported.

Four lots containing 4 large Yorkshire pigs each were used, and the rations consisted of separator skim milk and maize meal, buttermilk and maize meal, and skim milk and Kafir corn meal in each case 3:1, and wheat middlings (sharps) and maize meal 1:2 mixed to a slop with water. In the 49 days of the test the gain ranged from 66.25 lbs. per head on the wheat middlings and maize meal to 98 lbs. on skim milk and maize meal. The gain was most cheaply made on the last-mentioned ration and was most expensive on the Kafir corn ration. The shrinkage in dressing averaged 20 per cent of the live weight, and when marketed "the meat gave entire satisfaction as to quality and flavor" and was regarded as superior to imported bacon.

In the author's opinion so good results would not have been obtained with ordinary Kafir or unimproved pigs, "but even at a much lower rate of increase they afford a profitable means of disposal for a portion of the mealie crop."

Fattening pigs, M. RASQUIN (*Jour. Soc. Agr. Brabant et Hainaut., 52 (1907), No. 7, pp. 178, 179*).—From a summary of data the author concludes that sugar

in all forms is well worth the attention of pig feeders, as it is an important feeding stuff.

Breeding American carriage horses, G. M. Rommel (*Amer. Breeders' Assoc. Proc., 2 (1906), pp. 177–184*).—The cooperative investigations undertaken under the auspices of the Bureau of Animal Industry of this Department are outlined and discussed.

Poultry observations, C. K. Graham (*Connecticut Storrs Sta. Bul. 44, pp. 25–35, figs. 3*).—The author studied the causes of high mortality so often noted with young chicks and the effects of substituting snow for drinking water with laying hens and chickens.

When newly hatched chicks were given food mixtures containing salt, sawdust, sugar, and musty grains in addition to the usual feeds, it was noted that the salt and sugar were selected first, perhaps owing to their bright appearance, and that musty grain or sawdust was as readily eaten as more suitable food. Chicks 8 or 9 days old showed more discrimination in the selection of the materials eaten, and therefore the author believes that the death of very young chicks is often caused by eating musty grain accidentally present in their other feed, although as shown by the observations reported "there is no doubt that faulty brooders, chills, overheating, improper ventilation, and lack of vitality in the parent stock should all receive proper credit for their share."

When snow was supplied instead of water to laying hens it was noted that old hens were more affected than young birds. In one of the tests the egg production of the old hens was smaller "on the days when snow was on the ground, and also considerably less when the ground was frozen; that is, on the cold days when water was not accessible. These conditions do not seem to have affected the younger birds, and they show an increase in eggs immediately after each snow storm, gradually dropping back as the snow disappears."

In another test made under similar conditions, except that the houses were located in a drier locality "the cold weather did not affect the egg production, but there was a noticeable increase in the amount of grain eaten during the cold weeks, when comparison is made with the very mild ones. This, however, may have been caused by the birds foraging more during the milder periods. These birds did not appear to mind the cold and there was not the slightest sign of frosted combs among them, nor were there any colds."

Data regarding other lots are briefly reported and in general it was noted that "when snow was given there was generally an extra amount of feed required, although the increase in eggs more than paid for it." "The time saved by using snow and dry mashes amounted to nearly half that required in tending the fowls."

When cold water was compared with warm water the average egg yield was much the same, though slightly in favor of the latter.

"Snow was given to young chicks, but the results were disastrous; although chicks that were reared in outdoor brooders were let run on the snow crust during bright days when 3 weeks old or over and no serious results followed."

Poultry raising, J. G. Halpin (*Michigan Sta. Bul. 245, pp. 113–136, figs. 3*).—The station has begun extended studies of various problems connected with poultry feeding and in this bulletin an account is given of the equipment and plans.

To meet the present demands for information on various points connected with poultry raising, a general summary of data on the subject has been prepared, including such topics as food and exercise, selection and mating, incubation, brooding, handling young stock, feeding, care and management of pullets during fall and winter, construction of poultry buildings, and some diseases of chicks.

Poultry, H. RABY (*Orange River Colony Dept. Agr., Ann. Rpt., 2 (1905–6), pp. 87–97, fig. 1*).—Information is summarized regarding the poultry kept, the number of eggs produced, and the methods of raising and feeding chickens followed at the Grootvlei Experimental Farm.

In the author's opinion the most satisfactory method of feeding poultry for market under local conditions is to confine them in crates in a partially darkened fattening shed, which should give protection from wind and be well ventilated. During the first 3 days of the confinement the fowls should be fed sparingly, but afterwards given all they will eat 3 times daily and be supplied with an abundance of grit and water. About 16 days are required to feed the birds for market.

In a feeding test in which 122 birds were fed under these conditions from 7 to 24 days the average weight at the beginning was 3 lbs. 9 oz. and the average gain 1 lb. The calculated profit per head was 27 cts. "It was found during the course of the feeding period that the rate of gain became less after the second week and ceased to be profitable when 16 or 17 days had passed. Fifteen days on full feed appears to be the most suitable time for fattening." The feed consisted of maize meal, bran, and ground oats with the coarse husk sifted out 2:2:1 made into a stiff batter with water. "Skim milk should be used in preference to water when it is available."

Portable houses for poultry are considered desirable and the construction of such a house is briefly described.

Success in egg culture, H. V. HAWKINS (*Jour. Dept. Agr. Victoria, 5 (1907), No. 1, pp. 11, 12*).—A brief account of a successful attempt to keep ducks for egg production. The total number of eggs produced by 390 ducks and 50 fowls in 6 months was 34,860.

Report on small poultry stations, D. F. LAURIE (*Jour. Dept. Agr. So. Aust., 10 (1907), No. 7, pp. 431–436*).—A brief note on the aims, present condition, and work accomplished at the six small demonstration poultry plants recently established by the South Australia Department of Agriculture. Five of these stations are for the study of egg production and one for the production of table birds.

The sale of undrawn and cold storage poultry, E. M. ECKARD (*Chicago Clin., 20 (1907), No. 1, pp. 5–8*).—The author has studied the condition and appearance of chickens when kept for 6 months in cold storage, and also the bacteria of the intestines and related questions.

"Bacteria normally inhabiting the intestinal tract are not destroyed by cold storage, neither are the eggs of the blowfly. These bacteria and maggots develop during the rise of temperature that takes place after removal from cold storage before they are killed by heat. The bacteria pass through the walls of the intestines into the peritoneal cavity and liver, while the poisons formed by the bacteria are more penetrative and pass deeper into the muscles. That these products of bacteria, called ptomaines, are poisonous is shown by their effect upon the guinea pig even in small amounts. These poisons are not destroyed by heat as are the bacteria and produce the looseness of the bowels after eating this class of food. In large amounts this poison results in vomiting, severe intestinal pain, collapse, and even death. This is known as ptomaine poisoning, and for it there is no known antidote."

The author's report is preceded by a general discussion of cold-storage products and especially of cold-storage poultry, in which it is pointed out that when chickens are kept undrawn for a long period the fluid portion of the intestinal contents may pass into the adjacent flesh to the injury of the quality

of the product. With freshly killed poultry the matter is very largely a question of the purchase of something which is valueless, as the intestines and their contents may ordinarily be soon withdrawn.

As regards cold-storage products in general, "there may be some question as to the deleterious effect of prolonged storage. It may be reasonably contended, as it has been contended, that these products are fit for human consumption so long as they are palatable. However, the skillfulness of purveyors of foods in preventing apparent decomposition by the use of antiseptics and deodorants impresses us that we can not rely upon the senses in determining the poisonous character of foods."

Composition of body fluids in marine animals, S. BAGLIONI (*Beitr. Chem. Physiol. u. Path., 9 (1906), pp. 50-66; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 530, II, p. 869*).—Chemical studies of the body fluids of fish and other marine animals are reported. The body fluids of various marine invertebrates contain very variable amounts of protein. In higher mollusks and arthropods the amount of protein is important and the quantity of extractive nitrogen is small, being less than one-tenth of 1 per cent.

DAIRY FARMING—DAIRYING.

A profitable tenant dairy farm, L. CARRIER (*U. S. Dept. Agr., Farmers' Bul. 280, pp. 16, figs. 3*). This is a description of a dairy farm of 120 acres, located in southern Michigan, from which both owner and tenant received adequate compensation for their investment and services. Particular attention was paid to increasing the fertility of the soil.

Comparison of concentrates for dairy cows, J. R. FAIN (*Virginia Sta. Rpt. 1906, pp. 42-44*).—Cotton-seed meal and corn-and-cob meal were mixed in such proportion (139.5 to 360.5) as to contain the same amount of digestible protein as wheat bran. The mixed feed and the bran were fed to 2 lots of 8 cows each for 117 days. There was very little difference ($1.45) in the cost of feeding the 2 groups of animals for the time mentioned. The 8 cows fed bran lost 224 lbs. in weight, while those fed the mixed feed gained 90 lbs. The difference in the production of the 2 groups, amounting to 1,262 lbs. of milk and 81.6 lbs. of butter, was also in favor of the mixed feed. The author, therefore, concludes that just as good or better results can be secured from a mixture of corn-and-cob meal and cotton-seed meal as from wheat bran.

Potatoes as a feed for dairy cows, H. ISAACHSEN (*Ber. Norges Landbr. Höiskoles Virks., 1905-6, pp. 183-202*).—A study was made of the relative value of potatoes and turnips for dairy cows. Eight cows separated into 2 lots were included in the experiment, which lasted from March 15 to May 25. The cows received from 1.8 to 2.7 kg. of dry matter in the roots or tubers per head daily, from 8.8 to 13.2 kg. of potatoes and 20 to 30 kg. of turnips being fed.

The cows did not yield quite so much milk on potatoes as on turnips. The potatoes did not injure the health or general condition of the cows, nor was any deleterious influence to be noticed as regards the fat content of the milk, the time of churning, the water content of the butter, or the chemical properties of the butter fat, as shown by the iodin number, Reichert, and Köttstorfer numbers. The flavor of the butter produced on the potato ration was possibly not quite equal to that of the butter produced on the turnip ration. Practical experiences as to the value of potatoes for cows were also ascertained and are summarized in the paper.—F. W. WOLL.

Reindeer moss as a feed for milch cows, H. ISAACHSEN (*Ber. Norges Landbr. Höiskoles Virks., 1905–6, pp. 202–216*).—An experiment conducted by the author with 8 cows for a period of over 4 months showed that 1 kg. of moss can replace 3 kg. of turnips in rations for cows without producing any deleterious effect on the milk yield, the weight of the cows, or the fat content of the milk. The average of 5 analyses of reindeer moss was as follows: Water, 48.3 per cent; fat, 0.96 per cent; protein, 1.17 per cent; nitrogen-free extract, 18.1 per cent; fiber, 20.8 per cent; starch value per 100 kg. (Kellner), 18 kg.; digestible protein (artificial digestion), 65 per cent.—F. W. WOLL.

Department of dairying, W. D. SAUNDERS (*Virginia Sta. Rpt. 1906, pp. 47–49*).—Brief notes are given on the work of this department of the station during the year and official 7-day tests of 4 Holstein-Friesian cows are reported.

Investigations on the influence upon milk production of the nonproteid nitrogenous compounds of feeding stuffs, A. MORGEN, C. BEGER, and F. WESTHAUSSER (*Landw. Vers. Stat., 65 (1907), No. 5–6, pp. 413–440*).—This experiment is in continuation of the series of investigations previously noted (E. S. R., 18, p. 171).

During the first and fourth periods of 11 days each a goat and a sheep were fed a normal proteid ration. During the second period the proteids were in part replaced by amids prepared by extracting young plants with boiling water and evaporating the fluid extract to the consistency of a sirup. During the third period the amids were replaced by carbohydrates. The most favorable influence upon milk production was exerted by the proteid ration. The amids were not equal in value to the proteids, but were much superior to the carbohydrates. Further experiments along this line are planned.

On the influence of the feed on the creaming quality of the milk, J. SÄLAND (*Ber. Norges Landbr. Höiskoles Virks., 1905–6, pp. 220–226*).—The experiments conducted by the author indicate that milk produced on rations made up mainly of hay and straw, with only small amounts of concentrated feeds, gives considerable more cream than that produced by cows fed richer rations, consisting of roots and only a little hay and straw, with a good deal of concentrated feeds. This appears to be due to other properties in the milk than its fat content, such as a change in viscosity, differences in the condition of the casein, etc., which may be traced to the character of the feed eaten by the cows.—F. W. WOLL.

An investigation into the quality of milk produced by different breeds of cows at Elsenburg Agricultural College, G. N. BLACKSHAW (*Agr. Jour. Cape Good Hope, 30 (1907), No. 3, pp. 354–358*).—Determinations were made of the fat content of the milk of the Friesland, Jersey, Shorthorn, and Ayrshire breeds, and also of native Cape of Good Hope cows from October, 1906, to February, 1907. The milkings were made at 6.30 a. m. and 4.30 p. m. The milk of the Friesland, Shorthorn, and Cape cows averaged less than 3 per cent of fat in the morning. The milk of individual cows very frequently fell below the standard of 3 per cent of fat. The author, therefore, believes that much evidence should be secured before the British standard of 3 per cent of fat and 8.5 per cent of solids-not-fat should be accepted in Cape Colony.

The properties and value of the milk of sheep, A. BURR (*Molk. Ztg., 21 (1907), No. 14, pp. 359–361*).—This discussion of the composition and value of sheep's milk includes a compilation of analytical data.

On the milk production of Karakul sheep, L. ADAMETZ (*Österr. Molk. Ztg., 14 (1907), Nos. 6, pp. 73–75; 7, pp. 87–89, figs. 5*).—This Asiatic breed of sheep, known also as Persian sheep, is described and its importance for middle Europe

is pointed out. The milk of this breed has been used in the manufacture of Brinsen cheese in the Carpathian Mountains.

A classification of dairy bacteria, H. W. CONN, W. M. ESTEN, and W. A. STOCKING (*Connecticut Storrs Sta. Rpt. 1906, pp. 91–203*).—This is a revision of a preliminary classification published in the report of the station for 1899 (E. S. R., 12, p. 1083). The revision has been based upon extended laboratory investigations in which species collected from various parts of the world, including Canada, Germany, Switzerland, and Italy, have been studied.

Several forms previously described are not included, while a large number of new species are described. The technical descriptions of the different species include nearly all of the characteristics usually adopted for the general description of bacteria. The formation of indol and the reduction of nitrates have, however, been omitted as not having much significance in relation to dairy problems, with which the authors have been particularly concerned. In all about 160 types are described, with few exceptions all actual cultures obtained from dairy materials. In addition to the detailed descriptions of the different bacteria analytical keys and tables covering all types are given.

Classification of lactic-acid bacteria, F. LÖHNIS (*Centbl. Bakt.* [*etc.*], *2. Abt., 18* (*1907*), *No. 4–6, pp. 97–149*).—This is a review of the literature of this subject, with an appended bibliography.

The kinds of lactic acid produced by lactic-acid bacteria, P. G. HEINEMANN (*Jour. Biol. Chem., 2* (*1907*), *No. 6, pp. 603–612*).—The author has determined the kind of lactic acid produced by various species and strains of lactic-acid bacteria in pure and mixed cultures, and has also studied the influence of the purity of the milk and the temperature and length of time of fermentation upon the production of the different lactic acids.

The streptococci (*Streptococcus pyogenes, S. lacticus,* and *Micrococcus lanceolatus*) produced d-lactic acid and the bacilli (*Bacillus acidi lactici, B. aerogenes,* and *B. coli*) l-acid. This is offered as an additional proof of the similarity or identity of *S. lacticus* and *S. pyogenes* and also of *B. acidi lactici* and *B. aerogenes* (E. S. R., 18, p. 672). Milk soured naturally at room temperatures contained chiefly d-acid and at 37° chiefly r-acid, l-acid becoming in excess after varying lengths of time. The lactic acid produced in spontaneous souring varied, therefore, with the relative numbers of streptococci and bacilli, with the temperature, and with the duration of the fermentation. The purer the milk the longer the d-acid remained in excess. The presence of d-acid is, therefore, an indication of desirable dairy conditions. Racemic lactic acid, according to the author, is the result of the formation of pure d-acid and pure l-acid by at least 2 different species of micro-organisms.

Acid and rennet-producing bacteria in relation to the hygiene of milking, C. GORINI (*Rev. Gén. Lait, 6* (*1907*), *No. 8, pp. 179–185*).—The author has demonstrated the presence of bacteria capable of producing both acid and rennet in the galactophorous ducts in both normal and abnormal conditions. The significance of these organisms is discussed and the importance of rejecting the foremilk and of thorough milking is emphasized.

On a new micro-organism of ropy milk (Bacillus surgeri), P. DORNIC and P. DAIRE (*Bul. Mens. Off. Renseig. Agr.* [*Paris*], *6* (*1907*), *No. 2, pp. 146–149*).—The new bacillus studied and described by the authors was isolated from the serum obtained in the manufacture of casein. The bacillus is nonmotile, varies in length from 2 to 135 μ, and retains the stain by Gram's method. Spores have not been observed, though the organism resists a temperature of 85° C. for 45 minutes. A marked characteristic of the organism is the rapid produc-

tion of acid in cultures. The viscid substance soluble in water from which it is precipitated by alcohol reduces Fehling's solution.

The relative opsonic power of the mother's blood serum and milk, E. TURTON and R. APPLETON (*Brit. Med. Jour., 1907, No. 2415, p. 865*).—Cow's blood serum was found to have about one-half the opsonic power of human blood, the average for 3 cows being 0.49 for the tubercle bacillus and 0.71 for the *Staphylococcus pyogenes aureus*. The index of the milk of the 3 cows averaged about 0.25 for the tubercle bacillus and 0.18 for the staphylococcus. Ordinary market milk averaged 0.20 and 0.05, respectively, for the same organisms.

Milk and milk adulteration, A. J. J. VANDEVELDE (*Ghent: A. Siffer, 1907, pp. 110*).—This manual is written with the view of defining public responsibility in the matter of the production, handling, and sale of milk. Chapters are devoted to the composition of milk, causes of changes in the composition and properties of milk, nutritive value of milk, adulteration of milk, legislation relating to milk control in different countries, methods of analysis, the decomposition of milk, milk preservation, milk products, and a general discussion of the public duties and responsibilities of the producer, dealer, and consumer of milk, and also of public officials concerned.

Clean milk for New York City (*Rpt. N. Y. Milk Conf., 1906, pp. 86*).—In a conference held in New York City in November, 1906, the following subjects relating primarily to the milk supply of New York City were discussed by numerous speakers: Skim milk, pasteurization, infants' milk depots, model milk shops, inspection, legislation, and education.

The Danish pasteurization law (*Mælkeritid., 19 (1906), No. 46, pp. 967–979; Ugeskr. Landm., 53 (1906), pp. 754, 755*).—This is a report of the chemical department of the Copenhagen Experiment Station on the operations of the Danish law of February 5, 1904, directing the pasteurization of skim milk, buttermilk, and cream in creameries for the combating of tuberculosis in cattle and swine.

The report shows that 1,328 creameries were inspected during the year 1905–6 in accordance with the provisions of the law. Of the 6,801 samples of skim milk and 6,830 of buttermilk and cream taken by the authorities, 225, or 3.3 per cent, of the former, and 168, or 2.4 per cent, of the latter were found insufficiently heated. One thousand and seven creameries conformed to the provisions of the law, while 262 violated it through negligence or lack of care in the pasteurization of their products and paid the penalties imposed upon them by the courts.—F. W. WOLL.

The sterilization of milk; its sanitary necessity and practical realization, A. VOIGT (*Thesis, Leipsic, 1906; abs. in Hyg. Viande et Lait, 1 (1907), No. 3, p. 122*).

The sanitary control of the production and sale of milk in the United States, L. PANISSET (*Hyg. Viande et Lait, 1 (1907), No. 2, pp. 49–53*).—A brief general discussion of this subject.

The preservation of milk from a physiological standpoint, G. WULFF (*Abs. in Chem. Zentbl., 1 (1907), No. 13, p. 981*).—The author concludes from the results of his investigations that hydrogen peroxid added to milk not only exerts a bactericidal action, but also produces certain changes in the proteids of the milk.

The volatile water-soluble fatty acids in East Prussian dairy butter, RUSCHE (*Molk. Ztg., 21 (1907), Nos. 11, pp. 269, 270; 12, pp. 299–302*).—The results of the examination of butter from 7 dairies in East Prussia from August, 1905, to July, 1906, are reported. The cows were fed in the stable dur-

ing the months from November to April and pastured during the remainder of the year. The results are summarized in the following table:

The Reichert-Meissl and saponification numbers of East Prussian butter.

	August, September, October.	November, December, January.	February, March, April.	May, June, July.	Entire year.
Reichert-Meissl number:					
Average	25.59	29.67	29.55	28.18	28.25
Maximum	27.86	32.56	31.49	30.30	32.56
Minimum	23.43	27.11	27.90	25.51	23.43
Saponification number:					
Average	223.3	229.1	228.7	226.4	226.9
Maximum	227.3	235.5	234.7	231.2	235.5
Minimum	219.8	225.2	225.7	222.6	219.8

Danish butter exports, 1905–6, B. Bøggild (*Tidsskr. Landökonom., 1906, pp. 593–608*).—The total exports of butter for the year ended September 30, 1906, were 181,840,363 Danish pounds (200,024,399 lbs. avoirdupois), of which amount 168,146,990 lbs. went to Great Britain and 12,411,165 lbs. to Germany. The net exports were 144.8 million pounds, against 150.9 millions the preceding year. The average quotation for the year by the Wholesale Dealers' Association was 97.7 öre (1 öre=¼ cent), against 94.0 öre for 1904–5. No previous year has witnessed a larger income from the Danish butter exports than that of 1905–6, viz. over 161,000,000 kroner ($44,000,000).—F. W. WOLL.

Dr. Edward von Freudenreich, O. Jensen (*Milchw. Zentbl., 3 (1907), No. 3, pp. 119–128; Rev. Gén. Lait, 6 (1907), No. 7, pp. 154–160*).—This is a review of the investigations of von Freudenreich, the most important of which related to the ripening of cheese. Appended to the article in the *Zentralblatt* is a complete list of the works of von Freudenreich.

VETERINARY MEDICINE.

Proceedings of the American Veterinary Medical Association (*Proc. Amer. Vet. Med. Assoc., 43 (1906), pp. 432, pls. 10*).—The papers presented at the forty-third annual convention of the association in New Haven, Connecticut, August 21–24, 1906, have been previously noted (E. S. R., 18, pp. 98–100). A number of papers were read by title only and brief mention of them is made herewith.

The recent Federal meat-inspection legislation was explained by J. R. Mohler (pp. 142–144) with reference to its effectiveness and enforcement. The method of controlling rinderpest in the Philippines was described by A. S. Shealy (pp. 313–319). In obtaining serum, Chinese cattle are used chiefly, and all these animals are rendered immune before their serum is used. It has not been determined how long the serum will retain its vitality, but the results obtained from its use are highly satisfactory.

A menace to the goat and sheep industry in New England by strongylosis was set forth by J. B. Paige (pp. 320–344). The methods commonly recommended for ridding pastures of these parasitic worms are not always effective. Drainage of the land proved unsuccessful in a number of instances. Burning over the pastures in spring or fall is effective, but causes a loss of forage and in many locations is dangerous. It is suggested that burning might be confined to a narrow strip of land surrounding streams or swamps. A better system of feed-

ing is also urged. Pictou cattle disease was discussed by W. H. Pethick (pp. 345–349), who has found that this form of hepatic cirrhosis is due solely to eating *Senecio jacobæa*. The symptoms of the disease are described from a number of cases observed by the author.

A paper was presented by D. A. Hughes on the veterinarian as a business man (pp. 350–365). It was urged that while considerable business acumen is necessary to the success of the veterinarian the mere accumulation of money should not be his whole purpose in life, since considerable of the energy of the veterinarian must be expended in developing a knowledge of a rational control of animal diseases by stock growers.

Annual report of the superintendent, civil veterinary department, W. D. GUNN (*Rpt. Dept. Agr. Madras, 1905–6, pp. 48–63*).—The work of the veterinary college of the department of agriculture is reported to have been very successful during the year. The prevalence of foot-and-mouth disease was less pronounced than in former years. Rinderpest occurred to a serious extent, but the outbreaks were soon brought under fairly good control. Brief notes are also given on veterinary hospitals, pony breeding, and cattle fairs.

Report of the veterinary division, A. GRIST (*Orange River Colony Dept. Agr., Ann. Rpt., 2 (1905–6), pp. 107–128*).—Quarantine is still maintained in the Orange River Colony against cattle coming from the Transvaal on account of the east coast fever. Tables are given showing the prevalence of contagious diseases during the years under report and notes are presented on the status of foot-and-mouth disease, hog cholera, pleuro-pneumonia, blackleg, and various noncontagious diseases. The number of cases of mange has increased considerably during the past few years. Numerous cases of plant poisoning are reported and an account is given of geel-dikkop, the nature of which is not yet understood.

Report of the chief stock inspector, C. H. MORGAN (*Orange River Colony Dept. Agr., Ann. Rpt., 2 (1905–6), pp. 331–336*).—An attempt is being made to eradicate sheep scab by a simultaneous dipping of sheep throughout the colony. It is recommended that the period during which dipping should take place be reduced to 3 weeks. About 30 dips have been recognized in an official list, but lime and sulphur has given the best results and is recommended for general use. The application of carbolic dips or arsenical dips is subject to a number of disadvantages.

Reports of inspectors of stock for the year ended March 31, 1906, J. L. BRUCE (*New Zeal. Dept. Agr. Ann. Rpt., 14 (1906), pp. 141–179*).—During the season under report the general health of animals in New Zealand was quite satisfactory. A number of small outbreaks of anthrax occurred. Dairymen realize the importance of thorough milk inspection, and the regulation of the milk supply has been taken in hand more strictly than ever before.

During the past year the rabbit pest has caused considerable agitation among the farmers. In some localities objections have been raised to the use of poison in destroying rabbits, but the adoption of a bounty system has still more disadvantages.

Division of veterinary science, J. A. GILRUTH (*New Zeal. Dept. Agr. Ann. Rpt., 14 (1906), pp. 264–317, pl. 1*).—A statement is presented of the present organization of the veterinary force and the laboratory and meat inspection work. During the year there was only one outbreak of anthrax reported. A general discussion of tuberculosis is given with particular reference to its transmissibility from animals to man.

A number of experiments were carried out in the control of contagious mammitis. A highly recommended proprietary remedy used as an injection proved of no avail. Similarly injections of a 4 per cent solution of boracic acid failed

to bring about any rapid improvement in cases of the disease. Sodium fluorid used at the rate of from 1 to 5 parts per 1,000 gave better results when the treatment was continued for several days. None of these solutions, however, appeared to exercise any pronounced bactericidal effect. The method of making injections consists in introducing the solution into the affected quarter of the udder, after which the part is manipulated with the hands and the solution withdrawn after 10 minutes. The injection should be repeated 2 or 3 times daily.

Notes are also given on serum treatment for swine diseases, stomach staggers in horses, tumors in cattle, *Strongylus cervicornis* as a cause of parasitic gastritis in goats and other young stock, *S. strigosus* in rabbits, blackleg, and a new skin parasite of sheep apparently belonging to the genus Haematopinus.

Combating infectious diseases in the Transvaal, A. THEILER (*Deut. Tierärztl. Wchnschr., 14 (1906), No. 50, pp. 633–637*).—Tuberculosis has not become generally established among domestic animals in the Transvaal, apparently for the reason that most stock is kept for a large portion of the year out of doors. Anthrax is likewise observed only sporadically. Particular attention has been given to the control of glanders, epizootic lymphangitis, and sheep scab.

Contagious diseases of live stock as affecting their market value, J. J. FERGUSON (*Amer. Breeders' Assoc. Proc., 2 (1906), pp. 145–147*).—With the development of an effective system of inspection, the detection of contagious diseases in animals at large market centers has become easy. Statistics are given showing the number of animals of different kinds condemned at the chief inspection centers. It is suggested that plans be adopted by which the financial responsibility for disease in animals would fall more largely upon the first seller of the diseased animals.

Statistics on tuberculosis, J. BÖHM (*Ztschr. Fleisch u. Milchhyg., 17 (1907), No. 4, pp. 124–126*).—In the author's opinion more care should be exercised in reporting statistics on tuberculosis to differentiate between the different forms of the disease. It is suggested that careful distinction be made between uterine, mammary, pulmonary, and intestinal tuberculosis.

Tuberculosis, S. S. CAMERON (*Jour. Dept. Agr. Victoria, 4 (1906), No. 11, pp. 641–655, pl. 1*).—The etiology, symptoms, prevalence, and pathology of this disease are described in considerable detail and notes are given on the various forms under which tuberculosis occurs. Particular attention is given to a discussion of the mammary form of tuberculosis.

Bovine tuberculosis, A. W. GILMAN (*Bul. Maine Dept. Agr., 5 (1906), No. 4, pp. 119–153*).—The State department of agriculture of Maine has made a study of the prevalence of tuberculosis throughout the State and presents in this bulletin a general summary of the facts relating to the case. A copy is given of the State laws relating to tuberculosis, together with discussions by various authors on the infectiousness of the milk of tuberculous cows, the control of tuberculosis in cattle, the use of tuberculin, and related subjects.

The course of penetration of tubercle bacilli, A. CALMETTE (*Rev. Gén. Méd. Vét., 9 (1907), No. 98, pp. 49–57*).—In the author's opinion, von Behring's contention that most cases of infection with tuberculosis occur in early life has not been proved. Animals appear to be almost equally susceptible to the disease at all ages; in fact, it is held that adults are even more susceptible than younger animals to infection through the alimentary tract.

The author has undertaken a series of experiments in the immunization of cattle to tuberculosis through the alimentary tract. It has been found that young or adult cattle which have been fed small quantities of tubercle bacilli attenuated by heat resist fatal doses of virulent bacilli when given with the food. It has not been determined how long this immunity persists.

Immunization of calves against tuberculosis, F. Ondracek (*Wiener Landw. Ztg., 57 (1907), No. 11, p. 93*).—After a long experience with methods of controlling tuberculosis, the author recommends the clinical examination of cattle 3 times annually, diagnostic inoculations with tuberculin annually, and the vaccination of calves by the method of von Behring.

Vaccination for tuberculosis in cattle, Rossignol and H. Vallée (*Rev. Tuberculose, 2. ser., 3 (1906), No. 6, pp. 466–472*).—As the result of previous experiments in vaccinating cattle against tuberculosis at Melun, the authors came to the conclusion that vaccinated animals resist natural contagion from cohabitation with infected animals at least for a period of several months.

Further experiments have been carried out and animals previously treated have been kept under continued observation. It appears that bovo-vaccine shows some variation in virulence, as tested on guinea pigs, and it is therefore reasonable to suppose that its effects on cattle are not always identical. Cattle vaccinated by this method may be infected with tuberculosis by intravenous inoculation within 3 months, and immunity disappears entirely in some cases within a year. It was found that the resistance of vaccinated cattle to contagion from association with tuberculous cattle was not particularly marked and did not extend over a period of more than a few months. Judgment is therefore suspended regarding the ultimate value of this method of vaccination.

Tuberculosis of the esophageal musculature in cattle, May (*Deut. Tierärztl. Wchnschr., 15 (1907), No. 3, pp. 31, 32*).—The tissues along the trachea and esophagus, particularly the lymphatic glands, are often involved in cases of pulmonary tuberculosis in cattle. In one instance the author observed isolated tubercles in the musculature of the esophagus and was led to believe that these tubercles were due to a secondary infection from bronchial slime.

Diagnosis of anthrax in practice, L. De Blieck (*Tijdschr. Veeartsenijk., 34 (1906), No. 3, pp. 109–151, pl. 1*).—A detailed account is given of the means which may usually be adopted by the practicing veterinarian in making a bacteriological diagnosis of anthrax. The general discussion includes methods of identifying the anthrax bacillus, differential diagnosis between anthrax and related diseases, and the approved methods of sending material to laboratories for a bacteriological test.

Determining the effectiveness of anthrax serum, A. Ascoli (*Ztschr. Hyg. u. Infektionskrank., 55 (1906), No. 1, pp. 44–80*).—As a result of a long series of laboratory experiments, the author comes to the conclusion that the intravenous inoculation of anthrax serum gives rabbits a pronounced passive immunity toward virulent anthrax cultures. The results which are obtained within 24 hours after the injection, however, are not sufficiently regular to form a basis for determining the value of the serum.

Under certain conditions anthrax serum has the power of protecting guinea pigs against cultures of anthrax bacilli. The passive immunity produced by intraperitoneal injection of anthrax serum is manifested within 24 hours, whereas after subcutaneous injection it does not appear before 72 hours.

A microscopic study of the colostrum and the udder of cows in cases of parturient paresis, N. P. Rukhlyadev (*Uchen. Zap. Kazan. Vet. Inst., 23 (1906), No. 5–6, pp. 357–390, pl. 1*).—An elaborate microscopical study was made on 14 cases of parturient paresis in cows for the purpose of identifying the various bodies found in the colostrum and udder in such cases.

During this investigation the author found in the colostrum casts and other bodies closely resembling them in structure, but having a different contour, and also fat globules, leucocytes, red blood and colostrum corpuscles, epithelial cells, and granular amorphous masses. The colostrum in cases of parturient paresis

contained more casts than are to be observed in normal cases either before or after parturition. The casts are very similar to renal casts, but vary in size and outline. Those observed by the author in the colostrum, like renal casts, may be granular, homogeneous, of mixed nature, or of formed cellular elements (leucocytes and epithelial cells). In addition to these casts lamellated bodies are observed in some parts of the sediment.

A study of sections of the mammary gland disclosed the presence of similar elements in this structure, both in the alveoli and in the various milk ducts. The casts observed in the udder are in general very similar to the renal casts, but show some characteristic features in connection with histological elements of the mammary gland. These casts are described as exudative casts of the udder. The author considers that his investigations indirectly substantiate the view that renal casts have their origin in albuminous exudates.

Stomatitis or sore mouth, J. Spencer (*Virginia Sta. Rpt. 1906, pp. 32-34*).—Stomatitis in domestic animals may arise from a variety of causes, including mechanical, chemical, thermal, and bacterial irritants. The symptoms naturally vary according to the cause and stage of the disease, and the treatment must be adjusted to the cause. The usual treatment consists in a change of diet, in which the animal receives largely soft succulent food and the use of a mouth wash, such as chlorate of potash, creolin, or carbolic acid.

Foot-and-mouth disease, E. Leclainche (*Rev. Gén. Méd. Vét., 9 (1907), No. 97, pp. 1-9*).—Statistics are given on the prevalence of foot-and-mouth disease in Germany, Holland, Belgium, Switzerland, and Hungary, from 1888 to 1905, together with a brief account of the outbreak in New England. Suggestions are also made regarding suitable precautionary measures to be taken in controlling the disease.

Foot-and-mouth disease in the Villette market, Vacher et al. (*Bul. Soc. Nat. Agr. France, 66 (1906), No. 9, pp. 746-758*).—This is a symposium on the danger of the spread of foot-and-mouth disease in the cattle markets. The Villette market is considered as offering many opportunities for the rapid spread of foot-and-mouth disease, and stricter regulations for the control of this disease are believed to be necessary.

The bacteriolytic power of the blood serum of hogs, B. M. Bolton (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 95, pp. 62, figs. 4*).—The investigations reported in this bulletin concern the reactions which take place between *Bacillus choleræ suis* and normal and immune serum in hogs. Preliminary experiments were made with other bacteria. The Ehrlich theory of immunity is explained and illustrated for the purpose of indicating the bearing of the author's investigations upon the utility of the theory in the study of immunity.

The blood used in the experiments was drawn in a sterile condition from healthy hogs or from hogs injected from cultures of *B. choleræ suis*. Care was taken to ascertain that at the beginning of the experiments all hogs were in a healthy condition. The bactericidal power of the serum was tested at different times by bleeding the same hog at intervals of a few days. The variation in bactericidal potency of the serum is presented in tabular form, and a comparison made of the variation between venous and arterial blood in this regard.

The author summarizes the conclusions drawn from his experiments as follows: The bactericidal potency of hog serum varies from time to time and differs somewhat for different strains of *B. choleræ suis*. The attenuating effect of long standing is more marked in some samples of serum than in others under similar conditions, and the bactericidal power of venous blood is not always greater than that of arterial blood. The serum is rendered inactive

by subjection to a temperature of 54° C. for 30 minutes. The inactivity of immune serum except after dilution, which is known as the Neisser-Wechsberg phenomenon, was sometimes observed and sometimes absent. It is held that the theory of complement diversion by means of amboceptors may not only account for the behavior of immune serum but also that of normal serum.

The treatment of joint-ill, ECKARDT (*Wchnschr. Tierheilk. u. Viehzucht, 50 (1906), No. 49, pp. 961–969*).—The treatments usually recommended for this disease have almost uniformly proved to be of little or no avail. The author states that for the past 10 years he has used with considerable success an indirect treatment through the milk of the mother. It was first determined by preliminary experiments that the direct administration of colloidal silver and iodid of potash had little effect in controlling the disease.

The treatment adopted by the author consists in administering iodid of potash to the mother in large doses. Mares and cows will take 200 gm. in drinking water during a period of 14 days without showing any ill effects. The iodid of potash is rapidly excreted through the milk and appears in large quantities within 3 days after the treatment has begun. Detailed clinical notes are given on 6 cases in which striking success was had from this treatment.

Glanders in the bone, W. VAN DER BURG (*Tijdschr. Veeartsenijk., 34 (1906), No. 2, pp. 53–57, figs. 2*).—Brief reference is made to previous cases of this sort. The author had occasion to treat a case which had been diagnosed as a dermatitis, caused by friction of the harness. The horse soon showed symptoms of cutaneous glanders, and a post-mortem examination confirmed the diagnosis of glanders already reached by the author. Two of the ribs were badly affected with the glanderous process.

Mallein as a diagnostic and remedy for glanders, J. DE HAAN and L. J. HOOGKAMER (*Ztschr. Hyg. u. Infektionskrank., 55 (1906), No. 1, pp. 133–170*).—The authors' experiments with mallein and observations on glanderous horses lead them to the conclusion that mallein is the best known diagnostic for latent glanders. In their experience, glanderous horses which show no fever before injection show an elevation of temperature of 1½ to 2° C. within 12 to 16 hours after injection. Even in healthy horses mallein may produce a considerable elevation of temperature after about 16 hours, but the temperature rapidly subsides.

It is recommended that all horses which react to mallein and also show clinical symptoms of glanders should be destroyed. Reactors which show no clinical symptoms and suspected cases are to be kept under observation for 4 weeks and again tested with mallein. The authors consider that glanders is curable. In some cases the cure takes place within a period of 6 months, provided the animals are kept under favorable hygienic and nutritive conditions. The repeated use of mallein is believed to favor recovery from the disease.

The treatment of morbus maculosus in horses, H. BECKER (*Ztschr. Veterinärk., 19 (1907), No. 1, pp. 26–28*).—In connection with an outbreak of strangles a number of cases of morbus maculosus was observed. The author had good success in treating this trouble with a mixture containing one part camphor and 10 parts sodium chlorate in rye meal. Clinical notes are given on three cases in which this treatment was adopted.

"Pink eye" in Manchester, J. B. WOLSTENHOLME (*Vet. Rec., 19 (1907), No. 966, pp. 430–432*).—The author presents a summary of his observations on 52 cases of influenza as observed in one institution. During the height of the disease the pulse ranged from 60 to 62. The conjunctiva of the eye was reddened in a majority of cases. Only 3 out of 52 cases died. The highest

temperature observed in any case was 106.2° F., while in 17 cases the temperature reached 105° F. In one of these 17 cases the high temperature persisted for 7 days. The age of the horses ranged from 4 to 16 years, but the larger number of cases occurred among horses which were 5 or 6 years old.

The disinfection of stalls with dilute formalin solutions, J. SCHNÜRER (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 2 (1906), No. 1, pp. 43–57*).—It is often possible to get a better penetration with fluid than with gaseous formalin, especially in stables in which there are cracks in the floor and other parts. The author therefore tested the value of formalin in an aqueous 1 per cent solution. The disinfectant results were entirely satisfactory. The only disadvantage of the method consists in the fact that the fumes may be too severe upon the operator if the process lasts very long or in stalls where the ventilation is not good.

Trypanosomes, F. G. NOVY (*Jour. Amer. Med. Assoc., 48 (1907), Nos. 1, pp. 1–10; 2, pp. 124–127, figs. 10*).—The structure and biology of trypanosomes, pathogenic for animals, are described in detail, and notes are given on the transmission of trypanosomes and on the immunity produced in animals against protozoan diseases. Specific accounts are presented on the nature, etiology, and method of treatment of nagana, dourine, Gambian horse disease, galziekte, sleeping sickness, and related diseases.

The cattle tick, W. NEWELL and M. S. DOUGHERTY (*Crop Pest Com. La. Circ. 10, pp. 32, figs. 8*).—The authors present a general discussion of the importance of tick eradication to the improvement of animal industry in the southern States.

The life history of the cattle tick is described with particular reference to its agency in transmitting Texas fever and to the adoption of rational schemes for its eradication. Tables are presented showing the periods during which cattle and other animals must be kept off of pasture lands at different seasons of the year in order to free these lands from ticks and make it safe to readmit tick-free cattle upon them. On the basis of this practical information it is a relatively simple matter for stock men to free farm lands of ticks.

Stomach worms (Hæmonchus contortus) in sheep, B. H. RANSOM (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 102, pp. 7*).—The symptoms of infestation by this worm are briefly noted. In preventing the infestation of lambs with stomach worms two general plans are usually applicable. The ewes may be kept in a bare lot from which the lambs may escape to noninfested pasture for grazing. The danger of infestation is thus reduced to a minimum. Again, wherever it is practicable, the danger of infestation from stomach worms is largely eliminated if the lambs come in the fall rather than in the spring.

Brief notes are given on the direct remedies for stomach worms, including coal-tar creosote, bluestone, and gasoline.

Department of animal industry, N. S. MAYO (*Informe An. Estac. Cent. Agron. Cuba, 1 (1904–5), pp. 41–45*).—A brief statement is made regarding the efforts put forth to improve the grade of domestic animals in Cuba, together with notes on some of the more important animal parasites of the live stock.

The urology of rabies, C. PORCHER (*Jour. Méd. Vet. et Zootech., 57 (1906), pp. 716–732*).—A chemical and physical study of the urine in cases of rabies among dogs, rabbits, goats, and donkeys, disclosed the presence of sugar in nearly all cases which died of the disease or which were killed during its progress. On the other hand, the urine of healthy animals of the same species contained sugar in only 2 cases as contrasted with 29 cases in which no sugar was found. The sugar does not appear in advance of the development of the

symptoms of rabies and does not seem to bear any relation to the virulence of the rabies virus. Apparently it occurs with such regularity in the urine of rabid animals that it may be considered a diagnostic symptom.

Neutralization of rabies virus with the bile of biliary salts, C. LESIEUR (*Compt. Rend. Soc. Biol.* [*Paris*], *61* (*1906*), *No. 39*, *pp. 694*, *695*).—According to the experiments reported in this paper the bile of either normal or rabid animals has the power of neutralizing rabies virus in vitro within a few minutes. The biliary salts either isolated or in combination have the same power when used in solutions corresponding to those in which they exist in the bile. Injections of rabies virus neutralized by bile or biliary salts have no effect in preventing the development of rabies from subsequent inoculation with virus.

A study of the blood and cephalic fluid in dog distemper, J. SABRAZÈS and L. MURATET (*Rev. Gén. Méd. Vét.*, *8* (*1906*), *No. 96*, *pp. 663–668*).—In the nervous form of dog distemper a reaction is observed in the membranes of the brain. This reaction is characterized by a lymphocytosis and appears to be due to the toxic effect of the micro-organism of the disease, although the cephalic liquid is not infectious.

Surgical diseases and surgery of the dog, C. FRENCH (*Washington, D. C.: Author; London: H. Kimpton*, *1906*, *pp. XIII + 408*, *pls. 29*, *figs. 52*).—The various pathological conditions which occur in dogs and which may be treated by surgical methods are discussed in a comprehensive manner. Some of the more important bibliographical references are given in connection with each chapter. The subject-matter of the volume is classified according to the parts of the body affected by various diseases.

Fowl cholera, M. FRANCO (*Lavoura; Bol. Soc. Nac. Agr. Brazil*, *10* (*1906*), *No. 8*, *pp. 365–369*).—The symptoms and pathological anatomy of this disease are described. The author has had some success in preventing it by giving with the feed a mixture containing hyposulphite of soda, salicylate of soda, gentian, ginger, and sulphate of iron.

RURAL ENGINEERING.

Disposal of dairy and farm sewage, and water supply, O. ERF (*Kansas Sta. Bul. 143*, *pp. 125–139*, *figs. 8*).—In this bulletin are included the results of sewage disposal experiments conducted by the dairy department of the Kansas Station, as a result of which "the station is now ready to advocate a system that is comparatively inexpensive and is practical for every farm. In fact, in some cases it has proven to be a source of great profit when used for irrigating and fertilizing truck patches and farm crops."

The method, in brief, is an adaptation of the well-known septic treatment in combination with a system of subirrigation by tiles to dispose of the tank effluent. Plans are shown and described for properly draining the barns and for conducting the sewage of the house, barns, and dairy through the septic tanks. Several alternate plans are presented for septic tanks suitable for farms of ordinary size. The total cost of construction of a circular septic tank 10 ft. in diameter and with concrete walls and floor and wooden partitions is estimated at $42.50, while the cost of a rectangular tank of the same capacity 14 by 5 ft. over all, likewise constructed of concrete, is placed at $41.10.

Some information is also included on the care to be taken in the location and construction of a well for the water supply of the house and dairy.

Eighth biennial report of the State engineer of Wyoming, 1905–1906 (*Bien. Rpt. State Engin. Wyo.*, *8* (*1905–6*), *pp. 162*, *pls. 10*, *map 1*).—A report

covering the administrative and other work of the State engineer during the period 1905-6.

Great progress is reported in the development of irrigation in Wyoming, permits having been granted during the past two years for irrigating more land than is under irrigation in the State at the present time. These permits number 1,127 and provide for the reclamation of 1,315,011 acres of land, with 2,083 miles of canal and ditches, at a total estimated cost of construction of $4,427,275. A good sign of substantial irrigation development is the number of reservoirs constructed, there having been 343 permits for such structures issued in the past two years.

The report includes detail tables of the various permits and certificates issued, some discussion of the operation of land laws, a report of the surveys conducted by the State on the Shoshone Reservation, reports of the superintendents of the various water divisions, and the report of a committee appointed to revise, codify, and simplify the laws of Wyoming relating to water rights.

Farm irrigation in the Transvaal, C. D. H. Braine (*Transvaal Agr. Jour., 5 (1907), No. 18, pp. 354-361, figs. 3*).—In discussing suitable methods to be used in the irrigation of orchards the author suggests a new system which it is claimed will supply the water where it is most needed, at the roots of the tree. The method proposed is, in brief, to sink one or more pits the size of a post hole and about 2 ft. deep between each pair of fully grown trees, the depth and distance apart depending, however, upon the root system of the trees, the nature of the ground and subsoil, and the kinds of trees or plants. The holes are filled with grass, leaves, or straw to prevent the subsoil from dying out. Permanent holes may be lined with old bricks or drain pipes.

Hydraulic-ram boring apparatus (*Engin. and Min. Jour., 83 (1907), No. 16, pp. 761, 762, figs. 4*).—A description of a deep-boring apparatus developed in Germany and embodying several novel features applicable to the boring of deep wells and explorations of underground strata.

The principle of the apparatus is that of the hydraulic ram. A number of plungers, to the lower ends of which are attached the chisels, are contained in a drum-like casing which is slowly revolved. Water admitted through a pipe extending to the surface acts upon the plungers, to which a reciprocating motion is given as a result of the hydraulic-ram effect of the descending water, which acts upon and closes a valve, causing impact upon the plunger, after which the latter is returned to its original position by a spring. The water used flows over the surface acted upon by the chisels and produces a thorough rinsing, most of the sediment being conveyed to the surface by the upward current.

From 600 to 1,000 blows of the chisels are claimed per minute, and it is stated that holes of very large diameter may be bored. The use of such apparatus for deep-well boring in the artesian districts of this country and in those localities where wells are used for irrigation might be attended with some success.

Some notes on the storage and regulation of water for irrigation purposes, T. W. Seaver (*Jour. and Proc. Roy. Soc. N. S. Wales, 39 (1905), pp. XLIII-LXII, fig. 1*).—The author describes in the course of his discussion a simple but ingenious module, which is intended to provide a means for delivering a fixed quantity of water per minute independent of the stage of water in the supply tank or canal. It consists of a gate, free to slide up and down in front of the outlet, and suspended by a chain from one end of a lever, the other end of which is attached to a tank floating in the main canal.

To adjust the apparatus the gate is so placed that it will discharge the required amount of water under a given head. The chains from the gate and

tank are stretched taut up to the lever and the position of the latter marked on a board held vertically. By repeating this process for various heads, keeping the chains of the same length, a series of lines are obtained on the board. A curve is drawn tangent to these lines and the board sawed to the curve. If the lever is now placed upon and allowed to roll on the curve, the relation between the head of water and the size of the outlet must be such as to give a constant discharge from the outlet.

Thirteenth annual report of the commissioner of public roads, 1906 (*Ann. Rpt. Comr. Pub. Roads N. J., 13 (1906), pp. 176, pls. 12, map. 1*).—A report covering road construction and improvement in the various counties of New Jersey, giving the total mileage and cost. A number of papers, contributed by the county engineers on various subjects connected with road construction, and statistical data on the detail cost of various roads, together with the standard State specifications, form the greater portion of the report.

The value of oil in road improvement, A. DICKENS (*Kansas Sta. Bul. 142, pp. 113–124, fig. 1*).—This bulletin contains the results of the experiments conducted in certain parts of Kansas, as authorized by the legislature, on the use of crude oil for the improvement of public roads. Several short road sections were treated at Manhattan, Hutchinson, Maple Hill, and at Garden City, the experiments consisting in general of first putting the road in a fair condition, and then plowing it to a uniform depth and thoroughly pulverizing it with harrow and disk. Where the soil was loose sand, the road was merely worked to the proper form. The oil applied was what is known as residuum from the refineries, preliminary laboratory tests having shown that 1 gal. of residuum was equal in road-making qualities to from 2 to 4 gal. of the various oil samples. The oil was applied by a special sprinkling arrangement attached to a street sprinkler, the amount used varying from 0.5 to 6 gal. per square yard according to the conditions of the experiment. Observations were made upon the behavior of the road under traffic, and although the tests are regarded as incomplete the following conclusions were drawn:

"The thorough mixing of the earth and soil to a sufficient depth to form a waterproof crust is necessary. For heavy traffic, not less than 6 in. is desirable; for light driving, 3 or 4 in. should be sufficient.

"Oil roads will probably require repeated applications of oil, but it now seems that the amount required will decrease annually as the roads become smoother.

"With residuum at 86 cts. to $1 per barrel f. o. b., the total cost of road varied from $525 to $1,300 per mile for an 18-ft. road."

Alcohol motors in agricultural operations (*Deut. Landw. Presse, 34 (1907), No. 26, pp. 217, 218, fig. 1*).—The writer takes up some of the advantages of the alcohol motor in agricultural operations in Germany. Among these, he refers to the facility with which the motor can be put in operation as compared with the steam engine, in case it is desired to complete harvesting and threshing operations in anticipation of approaching bad weather, when the time required to fire a boiler and get up steam might mean the loss or injury of a portion of the crop. The absence of smoke and sparks is also thought to be an advantage over the steam engine in field use, as is also the fact that the use of the alcohol motor does not necessitate the expense of hauling water, the water consumption of the alcohol engine for cooling purposes being only about ½ gal. per horsepower hour, or 24 to 26 gal. water per day for a 12-horsepower engine.

To show the relative cost of different fuels, some tests are reported on a special motor in which, by the addition or removal of plates on the piston head, the compression can be conveniently changed for various fuels, such as alcohol and the other usual hydrocarbons, a compression of 15 atmospheres being used

with alcohol. The fuels tested were benzine, alcohol, and a mixture of alcohol with benzol and ergin. The motor was rated at 16 horsepower, but in the test with pure motor alcohol 21.96 horsepower was developed. The investigation proved that a mixture of ergin or benzol considerably lowered the fuel consumption, and at the present price of alcohol, benzol and ergin mixtures therefore considerably reduce the operating cost.

The following table shows the several fuel consumptions in pounds per brake horsepower hour:

Fuel consumption per brake horsepower hour.

Load in horse-powers.	Pure motor alcohol.	90 per cent alcohol, 10 per cent benzol.	70 per cent alcohol, 30 per cent benzol.	50 per cent alcohol, 50 per cent benzol.	90 per cent alcohol, 10 per cent ergin.	75 per cent alcohol, 25 per cent ergin.	50 per cent alcohol, 50 per cent ergin.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
20.25	0.84	0.73	0.66	0.58	0.76	0.69	0.62
16.22	.87	.77	.69	.61	.79	.72	.64
10.14	.96	.89	.80	.72	.92	.81	.78

In order to ascertain the cost of operation from these values, the mean consumption of 0.62 lb. per horsepower hour was assumed for a 12-horsepower engine adapted for use on a threshing machine. At the present prices in Germany of alcohol and the mixture ingredients, it was found that the cost of operation would be $1.90 per 10-hour day. The writer concludes that in view of the many advantages of the alcohol engine and the fact that it uses as fuel an agricultural product, such an engine is the most suitable of all the prime movers for farm purposes.

Industrial alcohol: Its manufacture and uses, J. K. Brachvogel and C. J. Thatcher (*New York: Munn & Co., 1907, pp. 516, figs. 107*).—After a general discussion of the adaptability of denatured alcohol to various purposes and its importance to the farming interests of the country, the authors devote several chapters to an account of the materials and processes involved in alcohol manufacture. Following this, some data, mostly compiled from foreign sources, are given on the use of alcohol for power, heating, and illumination, and statistics are presented on alcohol production in the United States and foreign countries.

Three months of denatured alcohol (*Sci. Amer., 96 (1907), No. 14, pp. 286, 287*).—In this article attention is directed to the present status of the alcohol industry under the denatured alcohol law, it being pointed out that no sweeping revolution of industrial or agricultural conditions, such as was predicted prior to the passing of the act, has as yet been brought about. Although certain ethyl alcohol industries have been stimulated, methyl alcohol production has in no way been materially affected. It is stated that denatured alcohol is now obtainable at from 35 to 40 cts. per gallon, depending upon the locality, and while this price prohibits active competition with gasoline or kerosene at present prices, there is every reason to believe that it will eventually decrease in price when uses are found for the by-products of its manufacture, and when its uses as a fuel and in the arts become more widespread.

The recent amendment to the law is mentioned in connection with the manufacture of alcohol on a small scale. Under this amendment denaturing warehouses may be dispensed with when the capacity of the still is less than 100 proof gals. per day, the alcohol being conveyed to warehouses for denaturing by pipes or cars. It is the opinion of the writer, however, that communal rather than individual distilleries, or, in other cases, distilleries operated on

the principle of the old-time grist mill, are the real hope of the farmer. "Even if small distilleries can be installed at a comparatively low cost alcohol can be distilled economically and profitably only when the production is continuous and on a larger scale than is possible on the average farm."

The engineering index, H. H. SUPLEE, J. H. GUNTZ, and C. B. GOING (*New York and London: Engin. Mag., 1907, vol. 4, pp. 1234*).—A large volume containing an index and brief digest of articles which have appeared in foreign and domestic periodicals during the past three years on all phases of engineering information, the book being of value to the rural engineer particularly for its references to irrigation, drainage, farm machinery, and related topics.

RURAL ECONOMICS.

Farm management, F. W. CARD (*New York: Doubleday, Page & Co., 1907, pp. XIII+270*).—This is the fourth volume in the Farm Library series.

The book is an outgrowth of a course of lectures to students at the Rhode Island College of Agriculture on the problems of the farm, the aim being to awaken interest and suggest methods of studying these problems rather than to present solutions of them. Practical suggestions regarding many economic phases of farm management are made with the view of showing that, under capable direction, farming as a business will compare favorably with many professional and industrial pursuits. In the author's opinion "farm administration, rather than farm production, is likely to receive special emphasis in the next forward movement for agriculture."

The scarcity of farm help and the remedy, K. OLDENBERG (*Ztschr. Agrarpolitik, 5 (1907), No. 2, pp. 74–86*).—The author calls attention to the lack of trained farm laborers in Germany due to the exodus into cities and to foreign emigration. The shorter hours of service, steady employment, and higher wages of industries, together with the social advantages in towns and cities over country life, are regarded as the chief causes of rural depopulation. Among the remedies suggested are the adoption by landowners of industrial methods as to hours, wages, employment, etc., the establishment of a government bureau to place the unemployed on farms, land colonization, and the teaching of agriculture in public schools. The last is regarded as likely to be most effective in ultimately turning the tide of emigration back to farm life.

Foreign agricultural laborers in France, M. LAIR (*Rev. Écon. Internat., 1 (1907), No. 3, pp. 527–570*).—Statistics are given which show that there has been a gradual reduction in the number of native farm laborers in France and a corresponding immigration of Belgians, Swiss, Germans, Italians, and Spaniards to do farm work.

The author describes the method of securing foreign laborers, their mode of living, hours of labor, wages received, and the advantages and disadvantages of this class of labor from the economic and national points of view. The majority of farm laborers work from spring to fall in France and then withdraw to their respective countries, taking with them annually in wages about 20,000,000 francs. At the same time statistics secured from magistrates in numerous districts show that crops could not be harvested without foreign help on account of rural depopulation in France. For this reason the difficulties in the way of legislation regarding foreign farm immigration are pointed out. This class of farm help is regarded as industrious, as of great importance in increasing the wealth of the country, and as presenting no danger regarding the deterioration of the French race.

The present importance of share farming in Tuscany, A. Gori (*Atti R. Accad. Econ. Agr. Georg. Firenze, 5. ser., 3 (1906), No. 4, pp. 339–354*).—The author describes various socialistic and communistic plans that have been proposed and practiced from time to time as a solution of the labor problem, presents a view of partnership farming in Tuscany, and shows how this method has resulted in improving the condition of farm laborers. The intellectual, moral, and physical well-being of farmers under this system is said to be greatly superior to that of industrial workers. Farming on shares is believed to offer a solution of the conflict between capital and labor in the rural districts of Tuscany.

Agriculture in Lombardy, P. Roux (*Jour. Agr. Prat., n. ser., 13 (1907), No. 7, pp. 212–214*).—The author describes farming under the metayer or share system in northern Lombardy, where intensive culture predominates and the vine and silk raising are the chief industries, and farming under irrigation in the south, where diversified farming and dairying are practiced. The methods of cultivating the various crops and the relations of metayer to proprietor are described.

Conditions of farm life in Lombardy (*Agr. Mod., 13 (1907), No. 9, pp. 127–129, figs. 2*).—The author describes a colonial farm and farmhouse as typical of the economic and social conditions of the peasantry of Lombardy. The returns for labor are said to be small; corn, rice, vegetables, and milk, with very little meat and cheese, form the principal part of the diet; while the dwelling rooms are small and overcrowded. The conditions surrounding the life of the peasantry are said to be far from enviable throughout the province.

Agricultural cooperation in Ireland, P. Lavollée (*Bul. Soc. Agr. France, 1907, Mar. 15, pp. 667–673*).—This is a résumé of a pamphlet by G. de Kozielsk Kossilowski on agricultural cooperation in Ireland.

The writer describes the organization and aims of cooperative creameries, agricultural societies, rural banks, poultry and egg societies, and other organizations, the data showing that there were in 1894 a total of 34 societies with 1,650 members, while in 1904 the figures were 778 and 76,963, respectively. The land law of 1903 is said to work favorably for the tenants. By its provisions the tenant under certain conditions can become the owner of land, advances being made by the government. At the close of 1904, 6,826 had taken advantage of the law and acquired possession.

The credit banks and the home industries societies are particularly commended. The banks number 200, with 11,257 members, and through them the department of agriculture advances to members sums ranging from £25 to £100, at 3 per cent interest. The home industries societies, the writer thinks, are worthy of introduction into France as a means of preventing foreign emigration and rural depopulation, both of which tendencies have diminished lately in Ireland on this account.

Agriculture in New Zealand, R. McNab (*Wellington: Govt., 1906, pp. 20, pls. 20*).—This pamphlet, by the minister for agriculture, gives information regarding the soil, climate, rural industries, and agricultural exports, with notes on government aid to agriculture and the land system of New Zealand.

The country is said to be peculiarly adapted to the raising of stock, while the yields of grain are the highest of any in the world with the exception of those of Great Britain. The colony's chief exports consist of wool, frozen meat, and dairy produce, and the agricultural products exported in 1905 were valued at £12,046,268, or 77 per cent of the total exports. The area in occupation in October, 1905, was 37,167,460 acres, of which 14,222,629 acres were under cultivation.

Agricultural returns for 1905 (*Recensement Agricole de 1905. Brussels: Min. Agr., 1906, pp. 261*).—The conditions which prevailed in the various provinces of Belgium during the year are described, and detailed statistics of hectares under crops, utilization of commercial fertilizers and feeding stuffs, number of domestic animals, etc., in comparison with the preceding year are reported. The number of farms in 1905 was 296,314, number of hectares cultivated 1,761,759, commercial fertilizers used 713,498,300 kg., feeding stuffs used 2,269,579,200 kg., and number of domestic animals 1,046,519.

Mutual agricultural fire insurance [in France] (*Semaine Agr. [Paris], 26 (1907), No. 1348, pp. 82, 83*).—An abstract of the annual report of the Mutual Agricultural Fire Insurance Societies of the East.

The report shows 450 affiliated societies; policies issued and reinsured during 1906, 2,400, covering risks to the amount of 20 million francs; present proprietors insured, 12,000, representing a capital of nearly 120 million francs; and a reserve fund of more than 300,000 francs.

Crop Reporter (*U. S. Dept. Agr., Bur. Statis. Crop Reporter, 9 (1907), No. 4, pp. 25–32*).—Statistics and notes on the condition of crops and aniamls and the supplies and prices of agricultural products in the United States and foreign countries are summarized. Data are given on the growth of the condensed-milk industry. In 1880, 13,033,267 lbs. were produced, valued at $1,547,588, while in 1905 the output was 308,485,182 lbs., valued at $20,149,282.

AGRICULTURAL EDUCATION.

Annual report on the distribution of grants for agricultural education and research (*Bd. Agr. and Fisheries [London], Ann. Rpt. Agr. Ed. and Research, 1905–6, pp. X+191*).—This report consists of a general report on the work of the year 1905–6, a list of the grants awarded, and four appendixes: (1) Reports on institutions receiving grants, (2) methods adopted by county councils for giving instruction in the manual processes of agriculture, (3) agricultural instruction provided by county councils in England and Wales in the year 1905–6, and (4) a statement showing the amount received in 1904–5 from the residue grant under local taxation and the expenditure for agricultural instruction in 1905–6 by county councils in England and Wales.

In the general report, attention is called to grants of $4,856 each to two additional institutions, the Hampshire Farm School at Basing, and the Ridgmont Agricultural Institute in the county of Bedford, both of which in their winter work correspond to the winter schools of Germany, and in the summer are conducted as dairy schools, mainly for young women. The number of students in the agricultural courses of the different institutions in 1905–6 is estimated at 34,000, as compared with 23,000 in 1904–5. The board has decided to issue a series of short monographs for farmers dealing with the results of agricultural experiments and demonstrations conducted under its direction. It is shown that in the different institutions 300 teachers took advantage of the special courses for teachers as compared with 238 in 1904–5.

The appendix on instruction in the manual processes of agriculture is mainly a compilation of replies received in response to a circular letter addressed to the several county councils for the purpose of learning what they were doing in the way of providing instruction in agricultural practice. It was found that the subjects in which instruction is given comprise plowing, drilling, mowing, setting out roots, harvesting, setting up sheaves, stacking, thatching (including rope and spar making), hurdle making, basket making, sheep-shearing, milking, hedging and ditching, land draining, pruning, grafting, budding, hop drying,

and fruit packing. In the majority of cases instruction was given for at least two hours a day and for 6 or more days, and the course usually ended with a competition and prizes for skill in the work that had been undertaken.

The development of agricultural education in Scandinavia, A. Ystgaard (*Ill. Agr., 11 (1906), No. 3, pp. 90–98*).—The writer reviews briefly the history of agricultural education, tracing it back to the garden of Albrecht Thaer, in the province of Hannover, Germany, at the end of the eighteenth and the beginning of the nineteenth centuries. He shows the development in the Scandinavian countries of elementary schools, their decline on account of a dearth of properly trained instructors, the rise of the higher agricultural institutions, and the subsequent development on a better basis of the elementary schools.

Tables are given showing 1 agricultural college and 33 lower agricultural schools in Norway, 2 agricultural colleges and 57 lower schools in Sweden, and 1 agricultural college and 23 lower schools in Denmark. Another table shows the area of these 3 countries, the population, and the percentage of rural population. The agricultural colleges in each of the 3 countries are briefly described. There is also a discussion of the elementary and special schools in the different countries.

An experiment in school consolidation in Canada, G. P. Phenix (*South. Workman, 36 (1907), No. 2, pp. 79–86, figs. 5*).—This is a description of the Macdonald Consolidated School in New Brunswick, which is located about 20 miles north and 12 miles west of St. John in the hamlet of Kingston. It is shown that while before consolidation the enrollment in the 7 districts was 125, after consolidation it rose to 166 in the first term and 175 in the second. The average attendance in the unconsolidated schools was 44 per cent of the enrollment and in the consolidated school 84 per cent. Thus the daily attendance has been trebled and the percentage of attendance doubled.

The writer states that "the real secret of the success of this school at Kingston is to be found in the intrinsic worth of the course of study and in the strength of the instruction in the school itself. The difference between the course of study here and in the ordinary country school is sufficiently suggested by the difference in equipment. The orchard, the grafting tools, the pruning knives, the spraying apparatus, the kitchen with all its household implements, the sewing tables, the benches and tools, and the laboratory for indoor work in the winter—all utterly foreign to the ordinary school—here have a definite use."

Figures are also given to show the influence of agricultural education upon the dairy industry in Canada.

Statistics of educational institutions, 1903-4 (*Österr. Statis., 77 (1906), No. 2, pp. XXXV+288*).—These statistics, published by the Royal Statistical Commission of Austria, show the classes and location of educational institutions, including agricultural and forestry schools, together with their date of organization, length of courses of study, number of persons in faculties, number of students in attendance, etc. Under agricultural and forestry institutions there are listed the agricultural division of the Royal University at Krakow, the agricultural high school at Vienna, 20 secondary and middle schools, and 162 elementary schools. The total attendance at these schools in 1903–4 was 6,690.

MISCELLANEOUS.

Eighteenth Annual Report of Connecticut Storrs Station, 1906 (*Connecticut Storrs Sta. Rpt. 1906, pp. XXIII+206*).—This contains a financial statement for the fiscal year ended June 30, 1906, reports of the director and heads of the departments, reprints of Bulletins 38–42 of the station, issued during the year, and a classification of dairy bacteria noted briefly elsewhere.

Sixteenth Annual Report of Kentucky Station, 1903 (*Kentucky Sta. Rpt. 1903, pp. XIV+322*).—This report, recently issued, contains the organization list, a financial statement for the fiscal year ended June 30, 1903, a report of the director on the work of the station during that year, reprints of Bulletins 105–112 of the station, miscellaneous chemical analyses made in 1903 and not previously published, and meteorological observations noted elsewhere.

Seventeenth Annual Report of Kentucky Station, 1904 (*Kentucky Sta. Rpt. 1904, pp. XIV+202*).—This report for 1904 is similar in form to the above. Bulletins 113–117 are reprinted.

Eighteenth Annual Report of Kentucky Station, 1905 (*Kentucky Sta. Rpt. 1905, pp. XVII+246*).—This covers the work and expenditures of the station for the year ended June 30, 1905. The report of the director includes a summary of the work of the station in regard to pure food. Bulletins 118–123 of the station are reprinted.

Nineteenth Annual Report of Louisiana Stations, 1906 (*Louisiana Stas. Rpt. 1906, pp. 28*).—This contains the organization list; reports on the work at the Sugar Station at Audubon Park, the State Station at Baton Rouge, and the North Louisiana Station at Calhoun; brief statements concerning the geological and soil surveys in the State; notes on the Adams Act, the meeting of the American Association of Agricultural Colleges and Experiment Stations at Baton Rouge, and on the experiment station exhibit at the State fair; and a financial statement for the fiscal year ended June 30, 1906.

Director's report for 1906, W. H. Jordan (*New York State Sta. Bul. 284, pp. 329–350*).—A review of the different lines of station work during the year.

List of cooperative experiments for 1907 (*New York Cornell Sta. Bul. 242, pp. 36–43*).—This is a schedule of the experiment demonstrations offered to New York farmers during the season of 1907. The experiments cover a wide range of subjects, which are grouped into 8 divisions, each in charge of a specialist. The divisions are as follows: Agronomy, plant selection and breeding, horticulture, entomology, animal husbandry, poultry husbandry, dairy industry, and plant diseases.

Report on the Southern Utah Experiment Station, 1906 (*Utah Sta. Bul. 97, pp. 24*).—A brief statement on the work of this station is made by the director and a more detailed report is made by the horticulturist. The latter report is abstracted elsewhere.

Report on the Central Utah Experiment Station (*Utah Sta. Bul. 98, pp. 25–44*).—This contains the act establishing the Central Utah Experiment Station, brief statements by the director on the organization and work of the station, and reports of the horticulturist, agronomist, and irrigation engineer. The report of the horticulturist is abstracted elsewhere.

Annual Report of Virginia Station, 1906 (*Virginia Sta. Rpt. 1906, pp. 60*).—This report contains the organization list of the station; a report of the director discussing the personnel, resources, needs, etc., of the station; a list of available bulletins; a financial statement for the fiscal year ended June 30, 1906; and departmental reports containing several original articles which are abstracted elsewhere in this issue.

Literature, November, 1904, to January 1, 1907 (*Ztschr. Agrarpolitik, 5 (1907), No. 3, Beilage, pp. 83*).—This is a classified bibliography of German books and periodical literature for the period specified. It includes political economy, veterinary medicine, animal industry, fertilizers, soils, field and horticultural crops, meteorology, forestry, and other topics.

NOTES.

Arizona University and Station.—The resignation is noted of V. A. Clark, agriculturist and horticulturist.

Connecticut Stations.—By an act approved May 1 the legislature has formally acceded to the provisions of the Adams Act, and provided that the funds shall be divided equally between the State and Storrs stations.

Florida University and Station.—H. P. Stuckey, assistant horticulturist at the Alabama Station, has been appointed assistant in cotton work in the station. The visiting committee from the legislature has recommended an appropriation of $40,000 for the erection of a building to be used for station, administrative, and laboratory purposes, and $5,000 a year for the ensuing biennium for farmers' institute work.

Idaho University and Station.—J. R. Shinn, field assistant in pomology in the Illinois Station, has been appointed professor of horticulture in the university and horticulturist in the station. A department of dairying has been established under the direction of J. H. Frandson, a graduate of the Iowa College, as professor of dairying in the university and dairyman in the station. It is planned to develop materially the work in dairying.

Iowa College.—According to *Breeders' Gazette*, V. R. Gardner, instructor in horticulture, has been elected assistant horticulturist at the MacDonald Agricultural College.

Kansas College and Station.—A recent act of the legislature designates the college as the State highway commission, and among its duties specifies the devising of plans and systems of highway construction and of regulations for the repair and maintenance of highways, the conducting of demonstrations in road building at the request of the county commissioners, the providing of trained demonstrators for this purpose, and the disseminating of information among the county commissioners, highway officials, and the general public. The department of domestic science is conducting a month's dietary study among its students. W. E. Mathewson has returned to the college as assistant professor of chemistry and assistant chemist in the station.

Kentucky College and Station.—H. W. Taylor, assistant entomologist and botanist in the station, has resigned to accept a position in the Indian Industrial School at Carlisle, Pa. The board of control of the station has authorized the construction of a piggery and of a propagating house. One wing of the agricultural building for the college is now being erected.

Louisiana University and Stations.—The university announces the establishment of a school of agriculture modeled closely after that at the Minnesota University. A. E. Dodson, farm manager at the Audubon Park Station, has resigned.

A description is given in *Demeter* of the new chemical laboratory in process of construction. A 3-story brick structure is being erected, with an interior of

reenforced concrete and steel, and fireproof throughout. The building is designed to accommodate over 1,000 students and will contain a main lecture room seating 200, a general laboratory for 170, smaller lecture rooms and laboratories, a library and reading room, offices, museums, etc. Special provision has been made along industrial lines. The basement will contain furnaces for assaying, ceramics and clay working, and special laboratories will be fitted up for work in agricultural analysis and the chemistry of the sugar, cotton, rice, and petroleum industries and their by-products. It is claimed that the laboratory as a whole will rank when completed among the largest and best equipped in the South, and that the sugar laboratory will be the most complete of its class in the world.

Maine University.—The college of agriculture has arranged for two months of demonstration work, beginning July 15. Under the proposed plan, a member of the staff will hold an afternoon meeting at some farm at which a practical talk and demonstration will be given. The subjects include milk testing, spraying, pruning and grafting, soil fertility, home mixing of fertilizers, and other topics. Arrangements have also been made to establish a forestry experiment station in cooperation with the Forest Service of this Department. The university is to provide 5 acres of land and will exercise immediate supervision of the experimental work. The object will be to determine the species and cultural methods best suited to Maine conditions. Prof. G. E. Tower is to be in charge.

Massachusetts College and Station.—A department of agricultural education has been established, its duties to include both instruction and research. This is an entirely new departure at the college and is believed to be the first attempt in this country to organize this kind of work on so broad a foundation. Normal courses will be offered to prospective teachers, and studies will be made of problems confronting agricultural teaching in colleges and schools of various grades, and of agricultural extension with a view to introducing agriculture into the elementary schools, establishing agricultural high schools, and correlating and unifying the agricultural instruction given in the State. The work will be in close cooperation with existing educational agencies, especially the State industrial commission. W. R. Hart, of the Nebraska State Normal School, who has had long experience in teaching and is the author of a number of monographs and other articles on educational topics, has been selected as the head of the department and will begin his duties with the next college year.

F. C. Kenney, at present assistant secretary of the Michigan College, has been appointed treasurer and will act as the business agent of the college and station.

Missouri University and Station.—Dr. R. M. Bird, assistant professor of agricultural chemistry and assistant chemist in the station, has resigned to accept a position as professor of undergraduate chemistry at the University of Virginia. A. E. Grantham, instructor in agronomy and assistant agronomist, has also resigned. P. L. Gile, a graduate of Harvard University, has been appointed assistant in chemistry, and F. G. King, a graduate of this university, assistant in animal husbandry in the university and assistant in feeding in the station.

Nebraska University and Station.—The legislature has appropriated $100,000 for new buildings and improvements, including $20,000 for the completion of the woman's building, $35,000 for a heating and power plant, $30,000 for a stock and grain judging pavilion, and $15,000 for a steer-feeding plant, tool barn, houses, etc. An appropriation has also been made of $25,000 for the substation at North Platte, about $10,000 of which will be used for permanent improvements and the remainder for maintenance during the ensuing biennium.

New Hampshire College and Station.—At a recent meeting of the board of trustees the presidency of the college and directorship of the station were

separated, E. D. Sanderson, professor of entomology and zoology in the college and entomologist in the station, becoming director.

New Jersey Stations.—James W. Kellogg has been appointed assistant chemist.

North Dakota College and Station.—A new board of trustees has been appointed, of which G. B. Hollister and C. E. Nugent, both of Fargo, have been chosen, respectively, president and secretary-treasurer. Additional appropriations have been secured from the legislature for the erection of an experimental milling building, the establishment and maintenance of a substation at Williston for the study of irrigation and dry-land methods, the construction and equipment of a horticultural greenhouse, and other purposes.

Oregon College.—W. J. Kerr, now president of the Utah College, has been elected president and will assume his duties July 1.

Porto Rico Station.—Oscar Loew, recently of this Department and at present connected with the College of Agriculture of the Imperial Unversity of Tokyo, has been appointed chemist to the station. He will enter upon his new duties about October 1.

Rhode Island Station.—A study of the soil and manurial requirements for certain plants grown under glass has been begun in the new greenhouse.

Utah College and Station.—At the recent session of the legislature a department of horse breeding was established at the college, with the animal husbandman and veterinarian in charge. Their duties include the licensing of all stallions standing for public service, the law being modeled after that in Wisconsin. G. M. Turpin has resigned as assistant chemist in the station.

Virginia College and Station.—Dr. Paul Barringer, dean of the medical department of the University of Virginia, has been elected president. W. A. P. Moncure, instructor in mycology in the college and assistant mycologist to the station, has resigned. Arrangements have been made to continue for another year the experiments in tobacco growing in cooperation with the Bureau of Soils.

Wyoming University.—The protracted litigation between the university and the Lander Agricultural College as to the disposition of the Federal funds has been terminated by a decision of the U. S. Supreme Court sustaining the contention of the university, which will therefore continue to be the recipient. The opinion was by Justice Moody, who held that these Government grants are to the State and not to a particular institution.

Agriculture in Summer Schools for Teachers.—Instruction in one or more lines of agriculture, nature study, and domestic science will be offered during the summer by Cornell, Illinois, Maine, Ohio State, and Tennessee universities, Connecticut Agricultural College, Washington State College, and the Stout Manual Training School of Menomonie, Wis. The New Jersey State board of education and State board of agriculture will unite in conducting a school of agriculture, industrial arts, and sciences at Cape May City, with courses in agriculture, home economics, and manual training. Other summer schools of agriculture have been noted in previous issues.

Forestry School in North Dakota.—Under authority of a law passed several years ago, a State school of forestry was opened January 7 at Bottineau, N. Dak., with an enrollment of 30 pupils. Since that time the State legislature has appropriated $25,000 for the erection of a new building. R. R. Thompson is in charge of the school, which offers courses in silviculture, soil physics, forest physiography, entomology, and plant pathology, and field work in horticulture, nursery, and forest planting. These courses are supplemented by courses in other sciences, mathematics, language, history, and civics, as well as by one year's work in the common branches in a preparatory department.

A New School of Horticulture and Basketry.—The minister of agriculture of France has recently issued a decree establishing the National School of Horti-

culture and Basketry of Fayl-Billot in the department of Haute-Marne. The citizens of Fayl-Billot and the syndicate of basket makers in the region have given the necessary land (22 acres) and $15,440 for the erection of buildings. The department of Haute-Marne is to give $200 and the ministry of commerce and labor $1,351 annually toward running expenses. The faculty will consist of a director and about 6 other instructors, and the course of study will extend over 3 years. Eugene Leroux has been appointed director of the school.

Schools Gardens in the District of Columbia.—At the last session of Congress an appropriation of $1,000 was made for the purpose of continuing and extending the school-garden work which has been carried on for a number of years in a cooperative way by the public schools and this Department. Beginning 4 years ago with a few gardens on the Department grounds and a little improvement work around a single school, the movement has grown until this year 700 children have gardens on the Department grounds, 124 school buildings in the District have gardens, and 160,000 packets of seeds have been sold for home gardens.

Massachusetts Forestry Legislation.—By a series of acts recently passed by the Massachusetts legislature, the salary of the State forester is increased from $2,000 to $3,000 per annum, the appointment by the local authorities, subject to his confirmation, of forest wardens with increased powers and duties is provided, and more stringent regulations are enacted for the better protection from fire of woodlands adjoining railroads. The limit of annual expenditure for forestry purposes of $5,000 is amended to permit the use of such funds as may be annually appropriated, and $2,000 may be expended in holding State conventions of the fire wardens.

Miscellaneous.—James A. Wilson, a graduate of the Minnesota School and College of Agriculture, now assistant professor of agriculture at the Crookston (Minn.) Agricultural High School, will succeed K. C. Davis as principal of the Dunn County School of Agriculture and Domestic Economy, Menomonie, Wis., at the beginning of the next school year.

Science notes the resignation of Prof. F. H. Storer, since 1870 professor of agricultural chemistry at Harvard University and dean of Bussey Institution, and his appointment as professor emeritus to date from September 1.

A recent number of the *Illustrierte Landwirtschaftliche Zeitung* states that Prof. J. Wortmann, of Geisenheim, has been appointed to succeed Dr. Rudolf Aderhold as director of the Imperial Biological Institute for Agriculture and Forestry, at Dahlem.

Maine Farmer for May 9 and 16 contains an interesting symposium by a large number of agricultural college and experiment station workers on the present demand and outlook for men with agricultural training and education.

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EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, Ph. D., *Assistant Director.*

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LIST OF EXPERIMENT STATION AND DEPARTMENT PUBLICATIONS REVIEWED.

Stations in the United States.

U. S. Department of Agriculture.

NOTE.—The publications of the United States Department of Agriculture, except those of the Weather Bureau, may be purchased from the Superintendent of Documents, Washington, D. C. For the publications of the Weather Bureau requests and remittances should be directed to the Chief of the Bureau. The price of the Record is $1 per volume, or 10 cents per number. The prices of other technical publications are given in the list above. The publications of the State experiment stations are distributed from the stations and not from the Department.

EXPERIMENT STATION RECORD.

Vol. XVIII. July, 1907. No. 11.

The most vital question before the experiment stations to-day is that of human equipment. State and Federal appropriations have increased at a gratifying rate and spacious buildings have taken the place of cramped and inadequate makeshifts, but the men to carry forward this work have not been prepared in suitable numbers to meet the growing demand. The pressure is now becoming intense and it is recognized that our work of development must come practically to a standstill unless there can be an influx of men specially trained for its service. The man is the starting point in all investigation and the all-controlling factor. Without a presiding genius at the head generous funds and elaborate equipment become ineffectual.

In view of the fact that endowments have increased by million-dollar steps, it is not surprising that there should be much difficulty in securing a corresponding equipment of men with a genius for observation, who have ripened into usefulness. And now that there is a systematic movement in the direction of more thorough investigation of agricultural problems, it is evident how little attention our colleges have been giving to the training of agricultural investigators, and how low a standard they have themselves placed upon the requirements of experiment station work. The chief reason for the present shortage is found in the new standards which are being established for this work rather than in the fact that a relatively smaller number of men are presenting themselves for it. These standards impose additional requirements and qualifications, and thus practically eliminate from consideration many who might formerly have been drafted upon.

In the past it has been possible to carry on certain grades of work with men who had had little beyond the agricultural college course, coupled with a few years of experience. Such men have a far smaller place in the future, for their limitations are soon reached and they can not fill satisfactorily the higher positions or carry on advanced lines of investigation. The appointment of unqualified men, even to meet existing exigencies, is now acknowledged to be of doubtful expediency. Many have been the disappointments from an untried

and undeveloped man placed in the midst of ideal surroundings and opportunities to which he failed to rise.

Insufficient preparation on the part of workers is responsible for many of the defects of station activity. To it is due the low standards of investigation frequently met with, inconclusive and incomplete work, and many immature conclusions and deductions. It is also responsible, in large measure, for the estimation in which the agricultural work is held by scientific men in general. The need is not merely one for men, but for men of special qualifications and preparation; for men as broadly and thoroughly trained as in any department of research, men who know the methods and the meaning of research. The selection of a station staff "calls for the divining rod rather than the dragnet," but unfortunately the latter has been called into service too freely for the best interests of the work, and the present condition has well-nigh compelled its use.

The report of the committee on experiment station organization and policy at the Lansing meeting dealt largely with this subject. It pointed to the fact that the unprecedented demand for men trained in agricultural subjects is resulting in the appointment to important positions of young men practically fresh from graduation, and necessarily deficient in their training. The responsibilities of these positions and the salaries attached are out of all proportion to either the experience or the scholarship of the men appointed. This was deprecated as being seriously detrimental to the kind of work now expected of the stations. Such work, it was urged, calls for special preparation following the college course, quite as much as investigation in any field of science. The reason for such appointments of unprepared men is usually found in the scarcity of men, but in some cases, unfortunately, is due to a low standard or a policy of false economy.

The committee urged upon appointing bodies the importance of securing men with the widest possible education and training, and upon the institutions "that they supply the proper conceptions of scholarship, which, under present conditions, the young men can hardly be expected to acquire as undergraduates, and that they make it clear to young men that satisfactory permanent service can come only through the best preparation the world offers. . . . The agricultural colleges are primarily fitting their graduates not for investigators and teachers but for practical work in husbandry. Good as the courses are for this purpose they are only preparatory to the more advanced study needed by the investigator and the teacher. They do not, nor can they perhaps be expected to, in their undergraduate work, furnish the atmosphere best adapted to the scientific spirit and ideal."

When the exigencies of the situation are such that an institution

finds itself compelled to advance to responsible position and good salary a man of inadequate preparation, the committee specially recommended "that the arrangement shall include a definite understanding to the effect that he shall at once enter upon graduate work in the institution in which he is employed, wherever this is at all practicable, and that in any event there shall be definite plans for his temporary relief in the very near future for the purpose of encouraging graduate study in the best universities of the world." It argued that every possible advantage and encouragement should be held out to men who enter this work to adequately prepare themselves for it.

In view of the necessity to which some stations have been driven these suggestions are worthy of consideration. They place upon the stations themselves the responsibility for seeing to it that the men they select for their work shall ultimately receive training which shall suit them to their vocation, give them the proper point of view, and inculcate the true scientific spirit. Without doubt a great deal of good can be accomplished in that way, and it will help to determine whether or not a man is worthy of encouragement in the work.

There were two other papers presented at the Lansing meetings which bore upon this general subject, and which evidence not only the attention which it is attracting among thoughtful men, but indicate how live a question the personnel of the stations has become. One of these addresses was by Dr. H. P. Armsby, as president of the Society for Promotion of Agricultural Science, and was devoted to Research as a Career. This dealt more than incidentally with the human element in experiment station activity.

Doctor Armsby naturally recognized the man as the central factor in research, and he pointed out that in urging means for the support of investigation "we are inclined to assume not only the present existence of an adequate body of investigators, but that their number, like that of operatives in a factory, may be indefinitely increased as occasion arises. . . . The investigator in agriculture, if he be a real investigator, is a student of science. He is not a mere observer of nature or of practice." Addressing himself to the subject of providing an adequate supply of workers, he considered what should be the training for research in agriculture and the most effective means of acquiring it.

In the first place, "the investigator should have a broad and severe training in science, including actual work in research under the direction and inspiration of an experienced investigator. He should not merely acquire a knowledge of the facts of science, but should saturate himself with the scientific method of thought and work." And in the second place, "the agricultural investigator must have an acquaintance with the practical problems and conditions of agricul-

ture," for his projects "must bear definite relation to the actual problems of agriculture." This is a broad and efficient programme for preparation. Ideally it should come from the agricultural college, but these colleges have as yet given but little attention to that grade of instruction, and it was considered doubtful whether they are at the present time able to provide this training and atmosphere. Under present circumstances it was advised that the prospective investigator spend some time at a nonagricultural university, or failing this, seek a position under some competent investigator where he can take part in and imbibe the atmosphere of research.

Doctor Armsby also considered the question as to whether the conditions surrounding agricultural research are such as to attract men and lead them to prepare for it, and he outlined some of the conditions which contribute to this. Research positions can be made attractive to men by affording opportunity to do work from which credit and responsibility may result. While there must inevitably be much routine work, this should not be organized on the factory basis. A large degree of responsibility and freedom should be allowed to each group of workers, for in this way individual initiative is preserved and encouraged and more opportunities for advancement are open to young men. "In this way the university function of the research institution is most effectively performed and the training of the young worker in the method and spirit of scientific investigation most rapidly advanced." Like all branches of scientific activity, the conditions should be characterized by a notable degree of academic freedom, and there must likewise be freedom of discussion.

While large pecuniary rewards can not be expected from research in agriculture, there should be a living wage which will enable the worker to have books, travel, maintain scientific affiliations, and live in a way becoming his position. Pressure of pecuniary needs should not force capable and competent men into other lines of work, "a tendency which has not been entirely lacking in recent years." But the pecuniary reward was considered only secondary, while the other reward, the satisfaction of rendering real service in the advancement of mankind, is such that it "should appeal with tremendous force to the generous soul of youth."

The other paper was by Dr. W. H. Jordan upon the subject of The Authority of Science, and likewise dealt largely with the conditions essential to effective inquiry, and especially the man side. Doctor Jordan developed in a very logical way the fact that the authority at present vested in science rests on conscientious scientific inquiry, which in turn rests upon the individual, for "science is an individual product." Since what we accept as science is not infallible, but

is subject to reversals, the reliability of scientific deductions is estimated largely on their authorship. "What is presented to us for truth takes form in the human mind, and the quality of what we are asked to believe bears a close relation to the development and equipment of the producing intellect. Unripe minds will inevitably produce unripe science."

This is a very pregnant thought, which lies at the bottom of experiment station efficiency. The station can be no stronger than its men. Its strength and efficiency and reliability are measured and restricted by the combined ability of its staff. Stimulating conditions, helpful supervision, suitable facilities and equipment count for much, but they are all secondary. "Material equipment is subsidiary to the intellectual," and the development of inquiry must logically begin with the prepartion of men properly fitted to conduct research that is worthy of the name.

Regarding the grade of attainments necessary to research in agriculture, Doctor Jordan made no concessions to other departments of pure or applied science, but argued that "all that is required for progress in any other field of inquiry whatever in the way of efficiency of organization, scientific acumen, and severity of method is required here." His specifications for the agricultural investigator were rigid: "The real investigator must have what we speak of as initiative, fundamentally a natural quality that has been trained and developed in an atmosphere of scientific inquiry. . . . The true scientific mind is the truth-loving, truth-seeking mind. . . . Investigators in certain fields of agricultural research should be something more than mere technicians in science; they should be ripened men who see relations broadly, men who know affairs as well as principles." And of the men needed to-day he said: "The present fundamental need is for more young men endowed with a love of learning, of scholarly habit, and with integrity of mind and heart, whose ambition is not for notoriety, but for the conquest of truth, and who, with more thought for service than for salary, are anxious to aid in laying broad and deep the foundations of human thought and activity."

Doctor Jordan characterized the present condition as "out of balance," and he urged that "we should bring the situation into balance by giving more attention to the development of men." He went further and made this a moral condition of request for increased funds, for he contended that agriculture has no right to ask for larger sums of public money to be used in the study of its problems until there are available more men who are adequately equipped for the work of inquiry. The responsibility for meeting this condition he laid squarely at the doors of the colleges. "The further development of agricultural work in the United States," he said, "lies pri-

marily with the colleges and universities in the preparation of men;" and since the influence of the teaching institutions is the primary factor in the progress of agricultural knowledge, he questioned whether it is not now the privilege and duty of at least some of these institutions to more fully nourish and develop the spirit of inquiry. "Should you not deliberately set about recognizing and encouraging scientific initiative among your students and organizing courses of instruction that will give a substantial preparation for the work of investigation?" A strong appeal was made to these institutions not to allow themselves to be wholly concerned with the commercial side of agriculture, but while advancing the intelligence and prosperity of the farm and the shop to promote the love of learning and uphold the standards of the scholar.

This voices a sentiment which is gaining increased prominence—that the agricultural colleges have a duty to science as well as to the practice of agriculture, and that they should be looked to to furnish the leaders in the various branches of agricultural work as well as in the industry. It should be one of their functions to stimulate young men to prepare adequately for experiment station service, and to inculcate the proper point of view as to the requirements of that service and the kind of preparation necessary. No young man would expect to enter the practice of medicine without special graduate work. Is less required of the man who is to seek out and interpret the laws of nature for his fellow-men?

Not all of the colleges are ready to offer graduate work, but many of them can discover among their students the exceptional man with the latent traits of the investigator, and stimulate and guide him in the direction of his development.

CONVENTION OF ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS, 1907.

E. W. Allen, Ph. D.,
Office of Experiment Stations.

This association held its twenty-first annual convention at Lansing. Mich., May 28, 29, and 30, 1907. The convention was the most notable one in the history of the association in that it actively participated in the celebration of the fiftieth anniversary of the pioneer agricultural college of this country. The significance of this anniversary to the land-grant colleges as a whole, and some of the features of the occasion, were referred to editorially in the previous issue.

It was an important day for all of these institutions—not merely one for self-glorification, but for sober consideration of the place which they should hold and are filling in American education, the outlining of high conceptions and standards of the mission and the duties of these institutions in a broad way, and the means by which these ends may best be met. These considerations lent a special value to the proceedings of the convention, and taken with the account of the celebration as a whole, to be published separately, will form a most interesting chapter in the history of the land-grant colleges.

The meetings of the first two days of the convention were held in the Masonic Temple in Lansing, and were devoted to the usual business of the association and its sections. These meetings were well attended and suffered nothing from the exercises in progress out at the college. About 130 delegates and visitors were registered, including visitors from Canada, Cuba, Germany, and Scotland. The third day, May 30, the session was held in a large assembly tent on the college grounds and formed part of the anniversary celebration. The programme was in charge of the association, and the session was presided over by its president. Three papers were presented relating to the land-grant colleges, which are noted further on.

Although this formed the final session of the convention, the association was largely represented in the exercises of the following day, "Jubilee Day." The morning session on that day was held in the assembly tent, and consisted of addresses by Secretary Wilson, for the Department of Agriculture; President Angell, for Michigan and its university; President R. W. Stimson, for the East; Dr. H. C. White,

for the South; President Benjamin Ide Wheeler, for the West, and President James, for the Middle West. The afternoon session was held in the open air, the principal feature being an address by the President of the United States. This address was listened to with the greatest interest, as it voiced the President's appreciation of technical education, his belief in the high mission of the institutions of which the Michigan Agricultural College is a type, and in the necessity to the nation of developing not only the business of farming, but also the men and women engaged in that occupation and the conditions surrounding their life. The address was widely reported in the public press, and was so logical and forceful that it will have a strong influence in the development of public sentiment.

Following the address, degrees were conferred upon the graduating class, and the following honorary degrees: Doctor of science, upon Dean W. A. Henry, Prof. Charles F. Wheeler, President H. C. White, Director C. F. Curtiss, Dean Thomas F. Hunt, William W. Tracy, and Gifford Pinchot; doctor of laws, upon President Angell, Dean Davenport, President W. E. Stone, H. W. Collingwood (editor of the *Rural New Yorker*, Mortimer E. Cooley (dean of the engineering department of the University of Michigan). Dr. W. H. Jordan, President E. A. Bryan, Prof. R. C. Carpenter (of Cornell University), and Secretary James Wilson.

There were numerous social functions connected with the celebration which the members of the association participated in and which added materially to the enjoyment of the occasion. Among these was a concert the evening of the 29th, at which Mendelssohn's Oratorio Elijah was presented; an illumination, torchlight procession, the "oak chain" march by the young women of the college, and a reception on the evening of the 30th; luncheon in the women's building the 30th and 31st, and visits to the buildings and fields of the college and station under the direction of capable guides. On Saturday, June 1, the association and other representatives to the anniversary were entertained by Parke, Davis & Co., of Detroit, who ran a special train from Lansing to Detroit for the delegates, serving breakfast en route, and escorted them through their extensive and interesting works. In the afternoon a steamer trip was enjoyed on the river through the courtesy of the same firm, dinner being served on the boat.

GENERAL SESSIONS.

The general sessions of the convention were presided over by Dean L. H. Bailey, president of the association, and Director M. A. Scovell, vice-president. Dean Bailey delivered the presidential address on the evening of the first day upon the subject, The State and the Farmer, which he discussed from the standpoint of self-help and

governmental assistance. He laid much stress on the importance of personal and local initiative in solving difficulties and effecting reforms, and discussed the general question as to what it is wise and just for the State to do in aid of the farmer.

His remarks dealt with the leading questions relating to the improvement of agriculture as an industry, the men connected with it, the conditions of country living, and similar educational and economic aspects. This led to a consideration of the various agencies of the State and of the nation for agricultural advancement, the respective functions of these agencies and their relationships, with an attempt to outline a logical and efficient system extending from the National Government to the individual farmer. The address was suggestive rather than exhaustive, and outlined so sharply many of the problems for future solution that the association voted to have it printed at once for distribution in advance of the proceedings.

The report of the executive committee was presented by its chairman, Dr. H. C. White, who briefly reviewed the events of the year. Among these were the increase of funds to the land-grant colleges through the passage of the Nelson amendment to the current agricultural appropriation act, and the designation of the colleges as depositories of public documents. It was deemed best to attempt no action relative to the establishment of a national university at Washington, as no further effort had been made by the National Association of State Universities or others interested. Through its chairman the committee had endeavored, at a conference held November 21, 1906, to secure the admission of the land-grant colleges to the benefits of the Carnegie Foundation for the Advancement of Teaching. While the views of the board of trustees are at present adverse to the admission of these institutions, no final decision has been reached, and an invitation to another conference in advance of the next annual meeting of the board has been received. Action relative to the occasional meeting of the association with the National Educational Association, for the discussion of the pedagogics of agriculture and allied subjects, was deferred in view of the efforts being made to secure the establishment of a department of rural education in that association.

The association adopted a resolution expressing its profound appreciation of the services of Hon. Knute Nelson, of Minnesota, in securing the increased appropriation to the land-grant colleges. President White was also authorized to conduct further negotiations with the officers of the Carnegie Foundation.

The report of the treasurer, Director J. L. Hills, showed a balance from the previous year of $958.38, receipts from dues of $1,440, and disbursements of $1,465.84, leaving a balance of $932.54. Subscriptions to the fund for the graduate school were also received from

seven institutions, amounting to $175. Of this amount, $125 was turned over to the University of Illinois toward paying the expenses of the last session of the school.

The report of the bibliographer, Dr. A. C. True, took the form of brief historical notes on some early agricultural text-books, the status of instruction in the natural sciences fifty years ago, an account of a convention held in Chicago in 1871, which is said to have been of marked influence in the inauguration of experimental work, and a résumé of the work of Dr. Albrecht Thaer, of Hanover, Germany (1752–1828), one of the founders of the present system of agricultural education in Europe, and indirectly a factor in that of this country. In the discussion that followed, other data of similar nature were brought out, and much interest was shown in the general subject. It was urged that a complete history of the agricultural educational movement in this country should be brought together at an early date, and a committee, consisting of Doctor True, Dean Davenport, and Dean Henry, was appointed to take charge of this matter.

The report of the committee on instruction in agriculture, presented by Doctor True, as chairman, stated that a series of exercises for elementary instruction in agronomy had been prepared and published as a bulletin of this Office. A more advanced course in agronomy, supplementing this and designed for the use of secondary schools of relatively high grade, had been made ready for publication. The preparation of similar elementary and secondary courses in animal production and related topics is to be undertaken. The subcommittees on college courses in rural engineering and home economices reported progress.

The report of the committee on graduate study, submitted by President M. H. Buckham, stated that preliminary arrangements had been made to hold the next session of the summer school at Cornell University, with the cooperation of the New York State Experiment Station, in the summer of 1908, with Doctor True as dean. Special attention is to be centered on the interrelations of the chemical and biological groups of studies. The value of the school to both the educational and investigational work of the association was pointed out, together with the necessity for adequate financial support. It was voted to continue the present system of asking contributions from the several colleges, and the amount was fixed at $25 for each institution, payable on or before July 1, 1907, and annually thereafter.

President K. L. Butterfield reported for the committee on extension work that a circular letter had been sent to the heads of the land-grant colleges, calling attention to the recommendations presented at the previous convention relative to the establishment of departments of extension teaching in agriculture. Replies received from

42 institutions representing 39 States were briefly summarized to show the status of the work in each case. Such departments are now formally established in 6 institutions, and in 3 others faculty committees have been appointed to study conditions and methods. Several institutions are hopeful of organizing the work in the near future, while at several extension work is proceeding along other lines. A lack of sufficient funds was in nearly every case reported as the chief obstacle to its development.

In connection with the extension work the need of a central agency to concentrate and correlate the efforts of the different institutions was emphasized by a number of speakers. A resolution was adopted favoring the granting of larger appropriations to the Office of Experiment Stations for the enlargement of its activities along the lines of "investigations and publications in relation to methods of instruction in agriculture relating to the farm, to the farm home, and to rural interests generally."

The report of the committee on station organization and policy was presented by its chairman, Dean Davenport. In view of some difficulty having been experienced by college and station workers in securing the publications of the stations, it was strongly urged that all the stations use the "official" mailing list prepared by this Office, either for mailing their bulletins or keeping their mailing lists revised, and that the institutions notify the Office promptly of all changes in their staffs. Inquiry developed the fact that only about two-thirds of the stations now use this list regularly.

A special feature of the report related to the kind of men suited to station work and their training. This is noted editorially in this number.

The committee expressed its appreciation of the work of this Office in furthering the interests of agricultural experimentation, and in view of the rapid growth of the stations and the increasing importance of these relations it was recommended that the association request its executive committee to confer with the Secretary of Agriculture with reference to its extension and reorganization as a bureau.

The report of the committee was adopted, together with its recommendations.

The commission on organization and policy in agricultural research, appointed in accordance with a resolution adopted at the last convention (E. S. R., 18, p. 797), made a brief preliminary report through its secretary, Dr. W. H. Jordan. Two subcommittees have been appointed, one to consider the scientific and technical aspects and the other the sociological and economical relations. The commission has held one meeting, and it is expected that another session will be held in November and a final report made to the association in the fall of 1908.

The interest of the association in the investigations upon human and animal nutrition was manifested in resolutions advocating the continuance of the investigations on human nutrition which have been carried on by this Office for several years past, and indorsing the establishment by the Pennsylvania State College of an institute of animal nutrition as an independent department of research. The executive committee was instructed to take such action in each case as would aid in securing permanence to these lines of work.

Prof. Robert Wallace, professor of agriculture and rural economy in the University of Edinburgh, at the invitation of the association gave an interesting talk on the live stock of Great Britain, prefacing this with remarks on agricultural education in the United Kingdom.

Remarks were made by Prof. S. B. Green and President G. E. Fellows in advocacy of securing national aid to the land-grant colleges for the establishment and maintenance of forestry courses through the receipts from forest reserves. The importance of more adequate State aid in such matters was emphasized by Dean Davenport.

Several speakers expressed their appreciation of the usefulness of *Experiment Station Record* to the station and college workers, and urged that provision be made, by appropriation or otherwise, for more detailed abstracts than are practicable under present conditions.

The third day's session of the convention was held at the Michigan Agricultural College, and was devoted to three addresses dealing with separate phases of the work of the land-grant colleges—agricultural education, engineering education, and research.

The first of these, The Development of Agricultural Education, was presented by Dr. Elmer E. Brown, Commissioner of Education. This included a brief summary of the evolution of the agricultural colleges and allied agencies, together with an interpretation of the agricultural education movement and its outlook. In his judgment the real and lasting strength of agricultural education is to be found not in isolation, but in close coordination with general education, and through this with the real life of the people. It should therefore aim to develop not only capable leaders—"scientific experts who shall be able to teach the people the principles underlying the arts of life," but also an intelligent constituency with "the skill to take the science of the scientist and transform it into the art of their lives."

"A system of agricultural training is therefore demanded complete in its sequence from the lowest to the highest. Our elementary schools and high schools in country communities are still to be primarily schools of general education, but with much more training in the arts of the farm and the sciences lying near to those arts; our State colleges of agriculture and mechanic arts are to prepare young men and young women to read intelligently the literature of scientific

agriculture, to form independent judgments in agricultural matters, and to bring their new knowledge into connection with the real work of the farm. These State colleges, moreover, are to provide well-trained teachers of agriculture and related subjects for the elementary and secondary schools; the colleges of agriculture, still further, are to be cooperative educational institutions and not merely special and local institutions; they are to cooperate with similar institutions in other States, in order that the work of one may be strengthened by the work of all, and cooperate with the universities of their several States for the innumerable advantages to both which may come from such united effort. The National Department of Agriculture is undoubtedly to continue its remarkably wide and influential work, its expert investigations, the issuance of manifold and vastly useful publications, and its furtherance of all manner of agricultural education and research in the several States. Finally, the Bureau of Education is to do as thoroughly as possible the part of this work assigned to it." Especially at the topmost reach, "there must be that which is not commonly recognized as education at all—the pure research of the pure scientist—for no education can continue to be really alive unless it draws directly from some source of new and abounding knowledge a fresh supply never yet handled and made common among mankind."

The Development of Engineering Education in the Land-Grant Colleges was traced by President W. E. Stone. He pointed out that engineering instruction developed in these institutions more rapidly than the agricultural phases, partly because it was more readily reduced to concrete pedagogical form. The extraordinary development in manufacturing, mining, and transportation, and the great wave of scientific discovery and invention also created an exceptional opportunity. To this the land-grant colleges readily responded, so that they have always been foremost in the essential development of engineering instruction and, in the aggregate, are to-day its principal exponents.

The evolution of engineering courses was stated to have been largely along original lines, its aim being the development of the power to do things effectively in the belief that this is the modern criterion of education. The policy of adapting the methods and scope of instruction to the distinct needs and conditions of our industries has evoked much criticism as to its educational value, but has resulted in the establishment of a new education with a new spirit which has won the confidence of the commercial world and become the chief bulwark against the prejudice toward the college graduate. Thousands of young men have been trained for careers of great responsibility, influence, and remuneration, to the great advantage of the material interests of the country. They have made important contributions

to technical and scientific knowledge, have led to a better appreciation of the value of the application of scientific study and methods to business and industrial operations, and have been productive of citizenship of a high quality.

At the same time, the work of these institutions thus far has been largely occupied with laying foundations. They have been burdened with the demand for practical men. A differentiation of the instructional work by which the more elementary phases will be administered in industrial, trade, and manual training schools is, however, forthcoming, leaving the engineering schools free to devote their resources to instruction and research in the higher branches of technology, with vastly beneficial results. The general establishment of experimental bureaus or laboratories analogous to the agricultural experiment stations was predicted as a logical step in this direction.

Dr. W. H. Jordan's address was upon The Authority of Science. This authority, he explained, is derived not from platform speculations, magazine exploitation of theories, nor reports of progress, but from severely tested and verified knowledge; and he proceeded to outline in a logical and forceful way the conditions which determine the reliability of scientific deductions, factors which have been inimical to agricultural research of the true type in this country, and the need of broader conceptions and greater freedom.

With a frankness that made his meaning unmistakable, but with a fairness and appreciation that recognized the full value of this great movement, the speaker pointed out that much of the so-called agricultural inquiry in this country has been not so much research as the exploitation of existing knowledge, obtained in many instances from foreign sources without amplification or adaptation. "Although important new truths have been brought to light, our efforts at inquiry have neither produced results nor commanded the respect of the scientific world to an extent commensurate with the generous means applied. During the past twenty-five years we have been busy, instead, with much agricultural speaking and writing." As a result, "we are now seeing with greater distinctness every year that the more complex and more important problems of agriculture are still unsolved, and that because of this our utterances to the practical man are still lame and halting." The investigator was pointed to as the primary consideration in scientific research, and he was considered from the standpoints of his personal equipment for investigation, his motives or point of view, and his environment.

Doctor Jordan made an earnest appeal to the colleges and universities to give more attention to the training and preparation of men for this work, and the inculcation of the proper spirit and point of view. "It is a serious question," he said, "whether we are right in our educational plans when we place almost the entire emphasis upon

the commercial or business side of agriculture and the industries, or whether in doing this we are promoting the highest utility of agricultural and industrial education." Without an increase in the supply of men he declared that increased funds can not be efficiently employed, and further agricultural development will inevitably be checked.

Portions of this notable address are referred to quite fully in the editorial pages of this issue.

The election of officers for the ensuing year resulted in the selection as president of J. L. Snyder, of Michigan, and as vice-presidents of E. A. Burnett, of Nebraska; H. H. Harrington, of Texas; E. A. Bryan, of Washington; C. D. Woods, of Maine, and H. C. Price, of Ohio. J. L. Hills, of Vermont, was reelected secretary and treasurer; A. C. True, of this Office, bibliographer; and H. C. White of Georgia, J. L. Snyder of Michigan, W. E. Stone of Indiana, W. H. Jordan of New York, and C. F. Curtiss of Iowa, as members of the executive committee.

In the section on college work and administration, R. W. Stimson, of Connecticut, was chosen chairman, and E. R. Nichols, of Kansas, secretary. C. E. Thorne, of Ohio, was chosen chairman, and P. H. Rolfs, of Florida, secretary of the section on experiment station work.

The vacancies in the committees occurring through the expiration of terms were filled by the following appointments: Committee on instruction in agriculture, H. T. French of Idaho and H. C. White of Georgia; committee on graduate study, M. H. Buckham of Vermont and R. H. Jesse of Missouri: committee on extension work, W. C. Latta of Indiana and C. F. Curtiss of Iowa; committee on station organization and policy, H. J. Wheeler of Rhode Island and E. B. Voorhees of New Jersey.

SECTION ON COLLEGE WORK AND ADMINISTRATION.

The programme of this section dealt largely with problems relating to administration and curriculum. The question of securing State support for land-grant colleges was presented by President Fellows and discussed by Dean Henry and President Stimson. A better appreciation by the public of the work and needs of the institutions was considered the chief desideratum. Among the agencies which had been found helpful in securing this by bringing the public into closer touch were mentioned the better-farming railway specials, the running of excursions to the colleges, summer schools, short winter courses, and the enlistment of the farmers' organizations.

The Selection and Retention of an Efficient Teaching Force was discussed by President W. E. Stone and others. A considerable divergence of opinion developed as to the most satisfactory means

of securing men, some preference being expressed for their training and advancement at a single institution, while others favored securing the best men wherever found. Transfers of instructors from one institution to another during the college year were deprecated, and the necessity of maintaining among instructors a feeling of permanency of tenure during good service was emphasized. A certain flexibility of salaries and the treating of each case individually was also recommended as beneficial in many instances. It was believed that much can often be accomplished even with low salaries by arranging congenial work and by providing adequate funds for the maintenance of the departments.

Special interest in this section centered around the question of the preparation of instructors for teaching the elements of agriculture and the mechanic arts as authorized by the Nelson amendment. President White opened the discussion, calling attention to the rapid development of agricultural education in the secondary and primary schools and the great dearth of competent teachers. The feasibility of preparing such instructors in the land-grant colleges was considered, and also the relations of these institutions to the normal schools in such work. President Bryan, of Washington, described the department of education in the Washington State College. He emphasized the necessity of supplementing instruction in the purely agricultural phases by the study of general pedagogic methods, and regretted that so little interest in agricultural education thus far had been taken by trained educators. President Butterfield outlined the scope and purpose of the department of agricultural education recently established in the Massachusetts Agricultural College, and Prof. C. B. Waldron, of North Dakota, described the three years' teachers' course in that State. Doctor True pointed out certain fundamental distinctions in the attitude of the land-grant colleges and the normal schools toward agricultural education. In his opinion, the fullest development was to come through a serious cooperation of all available agencies, including the colleges, the normal schools, the Department of Agriculture, and the Bureau of Education. A short history of an attempt to introduce elementary agriculture into the rural schools in Scotland and its failure by reason of the withdrawal of the government grants was presented by Professor Wallace.

A paper on Extension Work in Agriculture was presented by Prof. F. H. Rankin, of Illinois, who described salient features of that work, its significance, and profitable lines of development.

The Short Practical Course, Its Value and Importance, was discussed by Dean Curtiss. A letter of inquiry showed that such courses were conducted last winter in 34 of the 39 colleges reporting, with a total enrollment of 7,776 persons, an average of 228 to each State.

Opinions as to the value of the work were highly favorable, though its limitations as an educational agency are generally recognized. As a means of strengthening the institutions in clientage and public confidence their existence seems to have been fully justified. The present is apparently a period of transition, with a tendency to reduce the amount of the more extended short-course work and to place greater emphasis on that of college grade—a condition likely to be accentuated by the development of agricultural instruction in secondary schools. In the speaker's opinion, still further abbreviation of the short courses was to be expected and their eventual classification with extension work.

In the discussion which followed the consensus of opinion seemed to be that the secondary schools would not supplant the short courses,' but would modify their character to a marked degree and make their chief function that of centers of specialized instruction.

SECTION ON EXPERIMENT STATION WORK.

The general subject of the papers presented before this section was Present Day Problems in Plant Pathology. Under this heading Prof. M. V. Slingerland considered The More Urgent Problems in Insect Control, the problems being classified as national and local. In the first class were placed such introduced insects as the cotton-boll weevil and the gipsy moth, which menace great industries or the general agriculture of whole sections, and such questions as a national quarantine against insects and uniform nursery inspection laws, the solution of which must depend largely on national action. Of problems of a more local nature the San José scale, codling moth, peach borer, plum curculio, woolly aphis, and apple maggot were reported as especially needing consideration, together with a general study of insects living under ground, forest and greenhouse insects, plant lice, and many others. To gain control of these, exhaustive studies of climatic and other complex factors are necessary. Owing to the vastness of the field in this country, and the manifold demands made upon the entomologist for various kinds of work, it was stated that few, if any, of the insect problems had been worked out to the entire satisfaction of entomologists and agriculturists.

In a paper on Progress in the Control of Fungus and Bacterial Plant Diseases, Prof. F. C. Stewart expressed the opinion that more progress in the actual control of fungus diseases had been achieved during the past twenty-five years than in all previous time. This is due largely to the discovery and application of fungicides. A certain amount of assistance is probable from the selection of disease-resistant varieties, although it was believed that the importance of this factor may have been greatly overestimated. Much has still to be done on

the causes of the diseases, in the tracing of the life histories of many of the fungi, and especially in devising effective means of control. It was suggested that ignorance of the methods of practical agriculture has been responsible for many impracticable recommendations by plant pathologists, coupled with a disinclination to make field experiments. The speaker advocated thorough testing of methods of treatment on a commercial scale during a series of years as the safest and most effective method of procedure. Because of the complexity of many problems, cooperative investigations with the economic entomologist, the bacteriologist, the agriculturist, the horticulturist, or the chemist were considered as often very essential.

In a discussion of this paper the need for cooperation by investigators in different States in the study of those diseases which appear only at intervals in a given region, such as potato blight and rot and the downy mildew, was suggested. A similar opportunity was pointed out in connection with the introduction of resistant strains and varieties from other localities.

The Relation of Cultural Methods to Plant Diseases was presented in a paper by Dr. G. E. Stone.

The topic for general discussion was The Duplication of Work in Agricultural Investigation, led by papers by Director H. T. French on the duplication among stations, and by Prof. H. Garman on the duplication between the stations and the U. S. Department of Agriculture.

The special topic decided on for the next meeting was Milk Production, including Sanitation; and the subject for general discussion, The Relation of the Experiment Station to Instruction Work, with Special Reference to Its Popular Phases.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

The use of corrosive sublimate for the preservation of samples of milk for analysis, P. GRÉLOT (*Jour. Pharm. et Chim., 6. ser., 25 (1907), No. 9, pp. 423-428*).—Of the various antiseptics tested for the preservation of milk samples, mercuric chlorid has given the best results in the author's experience. The bichlorid is rendered more soluble by the addition of one-fourth of its weight of ammonium chlorid. A tablet suitable for preserving a 250 cc. sample of milk would contain 0.05 gm. of mercuric chlorid and 0.0125 of ammonium chlorid, and would lower the freezing point 0.006° C. The use of such tablets would avoid, according to the author, the many inconveniences of potassium bichromate.

The determination of fat in cream, M. SIEGFELD (*Molk. Ztg., 21 (1907), No. 13, pp. 331, 332*).—The Adams method and the Gerber acid method were compared. In the acid method the cream was weighed but not diluted with water. The averages of duplicate determinations by both methods agreed closely.

Determination of fat in condensed milk, S. HALS and O. B. KLYKKEN (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 6, pp. 338-345*).—Comparative determinations were made by the methods of Gottlieb, Adams, Gerber, and Schmid. The highest results were obtained by the Gerber method. In general, the results by the Gottlieb, Adams, and Gerber methods were unaffected by the addition of sugar. This was not true, however, of the Gerber method when the fat content of the milk was very low.

The refraction of fats and fatty acids, R. K. DONS (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 5, pp. 257-261*).—The difference between the index of refraction of butter fat and those of the insoluble fatty acids at a temperature of 40° C. is from 11.2 to 11.5. In the case of cocoanut oil the difference is 16.9, which is sufficiently great to permit of the detection by this means of the adulteration of butter with cocoanut oil.

The refractometric examination of milk and cream and its applicability in food control, E. BAIER and P. NEUMANN (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 7, pp. 369-384, figs. 4*).—The milk is treated with acetic acid and alkaline-copper-carbonate solution and centrifuged. Determination is made of the index of refraction of the ether solution of the fat. A table is given which shows the percentages of fat corresponding to the different degrees of refraction. Cream is diluted with 9 parts of skim milk of which the fat content has been previously determined. Comparative determinations by this method and the Adams and Gottlieb methods are reported. The variations were not marked.

Estimation of lactose and butter fat in milk chocolate, W. L. DUBOIS (*Jour. Amer. Chem. Soc., 29 (1907), No. 4, pp. 556-561*).—The author's results were summarized as follows:

"In order to prove a milk chocolate true to name it is necessary to establish the presence of desiccated milk. This may be done by estimation of lactose and butter fat.

"Heating a solution of lactose to 86° C. decreases the polarimetric reading by an amount which may be corrected by multiplying by 1.11.

"Sucrose and lactose may be determined in the same solution by polarizing the sucrose in the usual way and lactose at 86°, after the inversion of the sucrose.

"These sugars may be rapidly and accurately determined in sweet and milk chocolates by the optical method described.

"Butter fat in milk chocolate may be approximately estimated from the Reichert-Meissl number of the fat extracted therefrom."

The inversion of sucrose by acid mercuric nitrate, C. B. COCHRAN (*Jour. Amer. Chem. Soc., 29 (1907), No. 4, pp. 555, 556*).—The author gives the results of numerous experiments with acid mercuric nitrate solution as an inverting agent for sucrose. The method is considered capable of giving reliable results and is commended on the grounds of simplicity and ease of execution. As the acid mercuric nitrate does not affect the polarization of lactose, it may be employed with safety in the analysis of sweetened condensed milk.

The unification of reducing-sugar methods, P. H. WALKER (*Jour. Amer. Chem. Soc., 29 (1907), No. 4, pp. 541–554*).—This is an extension of the table of Munson and Walker, the two tables together giving the necessary data for all of the more common reducing sugars.

Improvements in the autoclave method of estimating crude fiber, W. BREMER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 8, pp. 488–490, fig. 1*).—In the author's opinion, materials may be more conveniently treated with glycerin-sulphuric acid in small porcelain cups than in porcelain evaporating dishes. Where the cups are used, less time is required and the results are fully as accurate. A metal stand for holding a number of the cups is described.

The amount of cellulose, lignin, and cutin in pepper and cocoa, H. FINCKE (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 5, pp. 265, 266*).—Determinations of pure cellulose, lignin, and cutin showed that not half of the so-called crude fiber of the substances examined consisted of cellulose. The determination of these constituents of crude fiber, in the author's opinion, does not furnish a better means for judging of quality than do values for total crude fiber.

[Laboratory apparatus] (*Delaware Sta. Rpt. 1903, pp. 113–116, fig. 1*).—Illustrated descriptions are given of an ammonia condenser for use in the Kjeldahl method and of a form of Bunsen burner with metallic connections for use in batteries or clusters.

METEOROLOGY—WATER.

Monthly Weather Review (*Mo. Weather Rev., 34 (1906), No. 13, pp. XVI+609–628, charts 6*).—This number contains a table of contents, list of corrections and additions, and an index of volume 34; a report of the Chief of the Weather Bureau for the fiscal year ended June 30, 1906; a report of the Forecast Division; and a summary of observations on pressure, temperature, precipitation, humidity, cloudiness, and other meteorological phenomena.

"The normal annual distribution of atmospheric pressure shows the existence of two well-defined high areas—one over the Ohio Valley, east Gulf, and South Atlantic States, and extending eastward over the Atlantic, with the crest, 30.10 in. or above, east of the Bermudas; while the second high area covers the Pacific between the Hawaiian Islands and the coast of Oregon and northern California, extending eastward into northern California and central Oregon.

"During 1906 high pressure covered the greater part of all districts east of the Mississippi Valley, except the Florida Peninsula and New England, and extended in a narrow strip westward over the lower Missouri Valley into the central Rocky Mountain and plateau districts.

"Pressure averaged unusually high over the eastern slope of the Rocky Mountains and in the upper lake region and northward over the Province of Ontario, where the normal was exceeded from 0.05 to 0.07 in.

"In a narrow strip along the coast of southern California and over the greater part of northern California and the western portions of Oregon and Washington, also over the Florida Peninsula, the pressure averaged slightly below normal; otherwise over all districts of the United States and Canada the average for the year was above the normal.

"The year was one of unusual warmth over nearly all districts. Along the entire northern border from the lower lakes westward to the Pacific the annual means averaged 2° or more above the normal, and across the border in Manitoba and surrounding districts the average for the year exceeded the normal from 3° to more than 5°.

"In the southern portions of Georgia and Alabama and over the Florida Peninsula the temperature averaged slightly below normal, also over western Texas and the greater part of New Mexico, Arizona, and Utah. . . .

"Maximum temperatures of 100° or higher were recorded in the upper Missouri Valley, at scattered points in the Gulf States, in central and western Texas, over the southern portions of New Mexico and Arizona, and the central portions of California, Oregon, and Washington.

"Minimum temperatures of 30° below zero or lower were confined to portions of northern New England, northern Minnesota, North Dakota, and to the elevated stations of the central Rocky Mountain district. . . .

"The total precipitation for 1906 was below the normal along the Atlantic coast from Virginia to central Florida, and over the Gulf coast from western Florida to Texas. The deficiency on the immediate coast line was very marked, ranging from more than 12 in. at Hatteras to nearly 20 in. at New Orleans. Precipitation was also deficient over New England, New York, Pennsylvania, the Lake region, central Mississippi and lower Missouri valleys, and over the north Pacific coast districts.

"In marked contrast with the deficiency along the Atlantic and Gulf coasts, the amount of fall over the Appalachian Mountain region from Pennsylvania southward to the central parts of the east Gulf States, and in a narrow strip westward over Alabama, northern Mississippi, central Arkansas, and northern Texas, ranged from 5 to as much as 25 in. above the average.

"Precipitation was also in excess over practically all the Great Plains district from central Texas to North Dakota, over the entire Rocky Mountain and plateau districts, and the Pacific coast from central Oregon to southern California.

"The annual fall was especially heavy over central and northern Texas and the central and western portions of Oklahoma, Kansas, and Nebraska, where amounts from 10 to 12 in. above the normal were recorded.

"In the central Rocky Mountain States, northern New Mexico, Arizona, Nevada, and central and southern California, the excesses were generally large, although at isolated points the amounts were less than the average.

"The year was one with rainfall in general sufficient for all ordinary requirements, and generally well distributed through the growing season. An unusual amount of cloudy weather was the rule in nearly all districts, and the relative amount of moisture was generally in excess of the average."

Report of the meteorologist, W. H. BISHOP (*Delaware Sta. Rpt. 1903, pp. 160–166*).—A summary of the usual observations for the year 1902.

Meteorological observations, J. E. OSTRANDER and T. A. BARRY (*Massachusetts Sta. Met. Buls. 219, 220, pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during March and April, 1907. The data are briefly discussed in general notes on the weather of each month.

Summaries of temperature, rainfall, and sunshine, E. F. LADD (*North Dakota Sta. Rpt. 1906, pt. 1, pp. 17–27*).—The temperature for each month of 1906, the rainfall for each month of that year and for each year since 1892, the monthly sunshine for each month of 1906, the daily wind velocity for each month, and the daily evaporation from the water surface for the months May to September during 1906 and 4 preceding years are given in tables and briefly discussed. The average temperature for 1906 was 47.3° F., being considerably higher than that of the previous year. The total rainfall, 17.7 in., was much lower than that of the preceding year, 30.76 in., and lower than the average for the past 15 years, 21.36 in. The total sunshine recorded for the year was 1,925.4 hours. "The total amount of water evaporated from a water surface for the five months [May to September] was 22.36 in., a monthly average of 4.472 in., and a daily average of 0.145 in. This is considerably less than for the preceding years."

Semi-arid America; its climate compared with that of South Australia, W. L. SUMMERS (*Jour. Dept. Agr. So. Aust., 10 (1907), No. 7, pp. 411–414*).—In view of the great interest which has been manifested in Australia in reports of wheat growing in semi-arid districts of the United States, especially in the Campbell system of dry farming, the author undertakes a comparison of the climatic conditions of South Australia and that part of the United States which is defined as semi-arid. The main differences between the climatic conditions of the semi-arid districts of the United States and the so-called dry districts of South Australia are summarized as follows:

"*South Australia.*—Where our average rainfall exceeds 15 in. the district is regarded as a safe one for wheat and sheep, while our 'dry-wheat areas' would average, say, 10 to 15 in. The elevation above sea level of these dry areas is from a few hundred to nearly 2,000 ft. The winter is somewhat cold, often frosty, with lengthy intervals between appreciable falls of rain. The spring is relatively dry, and hot, drying winds while the wheat is flowering often cause serious loss. The average summer temperature is high, and frequently the shade records reach 100° F. for a week at a time. The wheat is sown at the beginning of winter, has to make its growth during relatively cold weather, and mature its grain in the hot, dry months of late spring and early summer.

"*America.*—The rainfall of the so-called semi-arid districts appears to be from 18 to 20 in. The altitude is from 1,000 to 8,000 ft.; winter is cold, but dry. The summer is wet and war ., and extended periods without rain are rare. The wheat is sown in spring and harvested within about 120 days, and during the whole of the growing period relatively high temperatures rule, though, as previously pointed out, extremely cold weather is frequently experienced. Evaporation is consequently considerably less than in South Australia, and the frequency of the summer rains, even when limited, tends to replenish the losses by evaporation.

"It will therefore be seen that the contrast between the climatic conditions of the two countries is very marked, and that results in the American States can scarcely be compared with local results. Our experience with the so-called drought-resistant wheats which have been introduced into these regions during

the past eight or ten years has been that they keep on the ground too long—that is, make but little upward growth until the warmer weather sets in, and then too often before they mature their grain they are caught with hot winds. On the other hand, except in the coldest districts, our ordinary wheats make considerable growth before the spring sets in, and thus have more prospect of maturing their grain."

The weather maps of the public weather service, GROHMANN (*Sächs. Landw. Ztschr., 54 (1906), No. 50, pp. 1305–1310, figs. 2*).—The character and use of the weather maps issued by the German weather service are explained.

Weather predictions, JOCHIMSEN (*Landw. Wchnbl. Schles. Holst., 57 (1907), Nos. 10, pp. 137–139; 11, pp. 149–152*).—Brief explanations of weather predictions and their utilization in agriculture are given.

On purification of sewage waters, A. MUNTZ and E. LAINÉ (*Compt. Rend. Acad. Sci. [Paris], 144 (1907), No. 9, pp. 466–470*).—Experiments with filters of peat are reported which tend to show that it is possible by proper manipulation of this material to increase enormously the purification capacity of bacterial filter beds.

Nitrification of sewage, G. REID (*Proc. Roy. Soc. [London], Ser. B, 79 (1907), No. B 528, pp. 58–74, figs. 2; Jour. Roy. San. Inst., 28 (1907), No. 3, pp. 142–149*).—This paper reports the results of observations on the influence of the depth of filters and the size of particles on the efficiency of the purification. By means of shallow trays with perforated covers placed at 1 ft. intervals in a filter bed composed of ⅛-in. particles, studies were made of the progress of nitrification in the sewage at different depths. The results show that the nitrification took place very largely in the first 12 in. of the filter, and indicate that in general the efficiency of a filter is to be increased by extending its area and by using finer particles rather than by increasing its depth.

The bacterial treatment of sewage, W. D. SCOTT-MONCRIEFF (*Surveyor, 31 (1907), No. 790, pp. 331–333, figs. 2; Jour. Roy. San. Inst., 28 (1907), No. 3, pp. 117–141, figs. 5*).—Experiments similar to those recorded in the preceding article and with like results are reported.

SOILS—FERTILIZERS.

A review of the geographical and geological conditions of Alaska, A. RÜHL (*Mitt. Justus Perthes' Geogr. Anst., 53 (1907), No. 1, pp. 1–16, map 1*).—The general geology, hydrography, and climate are briefly reviewed. A colored map based upon that of E. C. Barnard, of the U. S. Geological Survey, illustrates the main features of the present knowledge of the physical geography of Alaska.

The agricultural-bacteriological examination of soils, R. PEROTTI (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis. Mat. e Nat., 5. ser., 16 (1907), I, No. 1, pp. 67–75*).—The author briefly reviews a number of the more important reports of investigation on this subject and reports a series of studies of the growth of soil organisms in a medium consisting mainly of an extract of peat in comparison with other standard culture media.

The peat extract was prepared by boiling 100 gm. of air-dry peat over a direct flame for 2 hours with 500 cc. of water and digesting another 100 gm. for 2 hours in an autoclave at 120° with 500 cc. of water, filtering, and combining the extracts. For use as a culture medium the extract was diluted until it contained about 1 per cent of mineral matter. This solution had a slightly acid reaction. Both the acid solution and that which had been made slightly alkaline were used in the experiments reported. The growth of micro-organisms was much more rapid in the alkaline extract to which glucose had been added

than in any of the other media used. The peat extract medium seemed to be especially favorable for the isolation of the nitrogen-fixing organisms.

Investigations on capillarity, II. Ollivier (*Ann. Chim. et Phys., 8. ser., 10 (1907), Feb., pp. 229–288, figs. 17; Mar., pp. 289–321, pls. 3, figs. 22*).—The results of these investigations are reported under four heads as follows: (1) Formation of small drops, variations in their weight and form, (2) the influence of compressibility on the formation of drops, (3) contact of water with wet surfaces, and (4) the direct and chronophotographic study of different stages in the regular formation of drops.

On the source, amount, and importance of carbon dioxid in soils, J. Stoklasa and A. Ernest (*Ztschr. Zuckerindus. Böhmen, 31 (1907), No. 5, pp. 291–307*).—Measurements of the carbon dioxid produced in different kinds of soils under a variety of conditions are reported, the results indicating that the two chief sources of this gas are the respiration of the roots of the higher plants and of the micro-organisms which occur in soils. From the data secured it is estimated that the roots of each wheat plant give off during each day of its period of growth an average of 0.03 gm. of carbon dioxid. It is further estimated that the micro-organisms in 1 kg. of cultivated soil respire 15 mg. of carbon dioxid in 24 hours, or 75 kg. per hectare per day for the 200 days of the year in which the temperature is 15° C. or above.

On lime concretions, E. Blanck (*Landw. Vers. Stat., 65 (1907), No. 5–6, pp. 471–479; abs. in Jour. Chem. Soc. [London], 92 (1907), No. 534, II, p. 295*).—Studies of the chemical composition and absorptive properties of concretions found in calcareous soils are reported.

The analyses reported show the concretions to consist mainly of calcium carbonate, silica, iron oxid, and alumina, with smaller amounts of various other constituents. Fifty gm. of the fine-ground concretions were shaken up with 200 cc. of tenth-normal potassium nitrate solution containing 0.943 gm. of potash and allowed to stand 48 hours. The absorption of potash was at the rate of 0.1904 gm. per 100 gm. of material and the solution of lime at the rate of 0.1096 gm. Treated in the same way with a tenth-normal solution of ammonium chlorid the absorption of nitrogen was 0.0592 gm. per 100 gm. of material and the solution of lime 0.136 gm. When treated with hundredth-normal monocalcium phosphate solution 100 gm. of material absorbed 0.52 gm. of phosphoric acid.

A comparison of ground and unground concretions showed that the absorptive capacity for phosphoric acid was greater in case of the latter than in case of the former. These results show that the concretions may exert a marked influence upon the absorptive properties of soils.

[The effect of] volcanic ash on crops, W. N. Sands (*Mo. Consular and Trade Rpts. [U. S.] 1907, No. 318, p. 41*).—A brief account is given of the decidedly injurious effect on cacao, cotton, pigeon pea, sugar cane, etc., of volcanic ash which fell on the Island of St. Vincent during the last eruption of Soufriere.

The agricultural value of the phosphoric acid of Belgian subsoils, C. Schreiber (*Rev. Gén. Agron., n. ser., 2 (1907), No. 1, pp. 1–8*).—The results of a series of pot experiments with typical ferruginous, clay, and sandy subsoils from different parts of Belgium are summarized, the crops used in the experiments being oats followed by clover. The results show that, while the subsoils contained a considerable percentage (0.62) of phosphoric acid, a very small percentage of it was assimilated by plants, it being apparently in such form that it was very slowly dissolved in the soil solutions.

Availability of phosphates in relation to soil acidity, A. R. Whitson and C. W. Stoddart (*Wisconsin Sta. Rpt. 1906, pp. 171–180, fig. 1*).—Tests of the acidity and fertilizer requirements, especially for phosphoric acid, in a large

number of soils, both in the field and in the plant house, are described. The results in general indicate with reasonable certainty "that acid soils need phosphates, and it will be possible, by a careful test of a soil with litmus paper, to tell if it needs, or will need in the immediate future, a phosphate fertilizer."

The nitrogen content of soils as affected by methods of farming, A. R. Whitson, C. W. Stoddart, and A. F. McLeod (*Wisconsin Sta. Rpt. 1906, pp. 160–170*).—Studies of cropped and virgin soils similar to those reported by Snyder of the Minnesota Station and Ladd of the North Dakota Station are reported.

Analyses were made of samples of soil from a large number of fields, the histories of which are fairly well known, and of samples of virgin soil surrounding and adjacent to them. Summing up the results it is shown "that, in 6 out of 21 cases, the difference in amount of nitrogen in the virgin and cropped soil is not enough to account for the crops which have been removed." It is suggested that this condition is a result of fixation of nitrogen by soil bacteria.

"On the average, the determinations show that the loss by leaching and denitrification amounts to only 22.3 per cent of the amount of nitrogen removed by crops. The evidence seems to indicate that in clay loam soils of moderate fertility more than four-fifths of the nitrogen lost is removed by crops.

"It is probably true that in soils of a higher degree of fertility, and especially where large amounts of fertilizers are used on land growing late cultivated crops, there is a larger loss of nitrogen by leaching and denitrification than is noted in the above cases. Nevertheless, the entire loss of nitrogen from these fields is, on the average, 37.1 per cent of their original content, as determined by this method. This indicates clearly the limited store of nitrogen in such soils and the importance of maintaining it by the growth of clover, or other legumes, and manure."

Denitrification in cultivated soils, G. Ampola and S. de Grazia (*Staz. Sper. Agr. Ital., 39 (1906), No. 6–7, pp. 593–609; Gaz. Chim. Ital., 36 (1906), II, No. 5–6, pp. 893–905; abs. in Chem. Zentbl., 1907, I, No. 7, pp. 655, 656*).—In continuation of previous experiments by Ampola (E. S. R., 17, p. 17) the authors here report a series of comparisons on volcanic soils of calcium and sodium nitrates and farm manures as regards the changes which their nitrogen undergoes in the soil and their efficiency when used singly or in combination on different crops.

It was found that the nitric nitrogen of calcium nitrate is more readily assimilated by plants than that of sodium nitrate, which is ascribed to the fact that calcium nitrate is the ultimate product of nitrification in the soil, and nitrogen in this form offers greater resistance to denitrifying organisms than that of sodium nitrate. This fact, first pointed out by Ampola in 1901, has been confirmed by recent experiments by Bellenoux (E. S. R., 17, p. 449).

It was also found that denitrification was less rapid in the case of well rotted manure than of fresh manure. Denitrification was apparently greater and the resultant yield of crops less in case of manure containing litter than in case of manure not containing such material. The application of straw to the soil in all cases caused a decrease in yield, and even when sodium nitrate was used with the straw the yield was but very slightly increased. The injurious effect of the straw both alone and in connection with sodium nitrate and manure is attributed in part to the increased aeration of the soil brought about by its use, which is believed to promote denitrification. The decrease in yield is attributed more especially to denitrification because the soils experimented with were such as are ordinarily benefited by aeration and are rendered more productive by the common practice of plowing under stubble or sod. It is

believed that the straw promotes denitrification by furnishing food for the denitrifying organisms in the form of pentosans. Calcium nitrate was more effective in combination with straw, manure, and like substances than sodium nitrate, being apparently more resistant to denitrification.

The yields were invariably lower when fresh manure was applied just before seeding than when applied some time before this operation. In order to obtain the best results, therefore, the manure should either be well rotted before it is applied or it should be applied some time before the seeding.

The objections noted in the case of straw were not found to hold in the case of green manures similarly used, and this is ascribed to the fact that the organic matter of the green manures is more rapidly converted into humus than that of the straw.

Comparative tests of different kinds of manure showed that the least denitrification and largest yields occurred in the case of sheep manure, the order of efficiency of other manures tested being cow manure, horse manure, cattle manure with litter, and horse manure with litter. In general, denitrification was more active with manure of horses than with that of cattle or sheep, the addition of litter in all cases increasing the rate of denitrification. The low rate of denitrification in case of manure from sheep is ascribed to the fact that with these animals the carbohydrate materials which serve as food for the denitrifying organisms are more thoroughly digested than in case of cattle or horses.

The results do not warrant the conclusion that stable manure is of questionable value, provided care is taken to use manure in a proper state of decomposition or to apply it a sufficient length of time before seeding or before application of nitrates.

Relation of soil bacteria to nitrogenous decomposition, C. HOFFMANN (*Wisconsin Sta. Rpt. 1906, pp. 120–134, fig. 1*).—The rate of decomposition as measured by the formation of ammonia and nitrates in the nitrogenous matter of blood meal, bone meal, bran, and peat was studied in culture experiments with gelatin extracts, according to Remy, of 4 distinct types of soils, namely, black marsh soil sandy in character, a heavy sticky clay, a light sandy loam, and a pure sand. The facts apparently established by the investigations are summarized as follows:

"The numbers and the character of the bacterial flora in soils are largely influenced, first, by the nature of the fertilizers applied, and second, by the character of the soils themselves.

"The number of bacteria in sand is the smallest, amounting to only about one-fifth of that found in the black marsh soil, which contained the greatest number of any of the four soils.

"The total number of bacteria which may develop in soils richly fertilized is enormous, aggregating hundreds of millions per gram.

"The degree of nitrogenous decomposition is, in a general way, directly dependent upon the total number of bacteria present.

"The progress of such decomposition is marked by numerous fluctuations which coincide, in a general way, with an increase or decrease in the number of bacteria.

"Extensive ammonification invariably occurs before nitrification becomes active. Large amounts of ammonia may be formed in soil, without interfering with the subsequent development of the nitrate-forming organisms. In soils highly fertilized, as in the foregoing experiment, appreciable amounts of ammonia are invariably present.

"As regards the degree of decomposition, the soils tested rank in the following order: black marsh, clay, sandy loam, and sand.

"When based upon their relative susceptibility to decomposition, the fertilizers used rank thus: blood meal, bran, bone meal, and peat. In other words, where immediate effects are required, blood meal and bran are preferable; but where the beneficial action of the fertilizers is to be maintained for several years, bone meal and peat are better.

"The use of anaerobic conditions has no advantage over the aerobic method, but is, instead, far more difficult to manipulate."

Observations on an important group of soil bacteria. Organisms related to Bacillus subtilis, F. D. CHESTER (*Delaware Sta. Rpt. 1903, pp. 42–96, figs. 12*).—This is a preliminary report on the morphology, cultural features, chemical functions, classification, and description of this group of organisms which is understood to include "those members of the genus Bacillus, as defined by Migula, which produce spores, liquefy gelatin, and grow under aerobic conditions." The investigations here reported covered a period of nearly 2 years and involved the comparative study of a large number of cultures.

On nitrogen assimilation by lower organisms, B. HEINZE (*Landw. Jahrb., 35 (1906), No. 6, pp. 889–910*).—Accounts are given of studies and discussions of nitrogen assimilation by nitrogen-collecting bacteria (alinit and root-tubercle bacteria), fungi, algæ, and Azotobacter organisms. The importance of the fixation of free nitrogen from the standpoint of practical agriculture is also considered.

There was practically no fixation of nitrogen by alinit and pure cultures of root-tubercle bacteria in the experiments made by the author in media free from and containing nitrogen. The same was true in culture experiments with *Phoma betæ*, *Aspergillus niger*, *Penicillium glaucum*, and *Mucor stolonifer*. In experiments with Dematium-like molds and yeasts obtained from ordinary cultivated soil and of Streptothrix-like fungi from fallow soil there was some fixation, but this is ascribed only indirectly to the organisms named in that they are believed to have furnished food for other organisms which brought about the fixation. This indirect action is due to supplying organic food and also to the fact that the fungi dissolve lime phosphate, which favored the growth of the nitrogen-fixing organisms.

In culture experiments with Chlorella derived from ordinary cultivated soil, fallow soil, and sandy soils there was no appreciable fixation of nitrogen. With both pure and impure cultures of Nostoc there was decided fixation of nitrogen when proper conditions of food, temperature, etc., were maintained. It was observed in these experiments that both the blue-green and the chlorophyll-green algæ elaborate glycogen, a very available source of energy for nitrogen-fixing organisms.

Culture experiments with different Azotobacter organisms under a variety of conditions led to the conclusion, among others, that dibasic and tribasic potassium phosphate and dibasic calcium phosphate are especially favorable to the growth of these organisms. The best results as regards temperature were obtained at 20 to 30° C., although the organisms showed more or less activity at temperatures as low as 8 to 10°. Increases of nitrogen, due to fixation by Azotobacter organisms, of as high as 250 to 350 per cent were observed in the experiments reported. Pectin and pentosan substances were not as efficient sources of energy as sugar.

It is explained how these organisms gradually build up protein compounds from free nitrogen, and pot experiments are reported which show that the nitrogen of this Azotobacter material is much less readily assimilated than that of nitrate of soda. Field experiments on fallow soil are referred to as indicating that decided fixation may be brought about under such conditions

by careful attention to thorough cultivation, aeration, addition of humus (carbon supply), and suitable phosphates.

On some new nitrogen bacteria with autotrophic habits of life, H. KASERER (*Ztschr. Landw. Versuchsw. Österr., 10 (1907), No. 1, pp. 37–42*).—A preliminary report on studies which have already been briefly noted (E. S. R., 18, p. 534).

The author gives a number of chemical reactions which indicate that ammonia may not only be oxidized to nitrite, but also directly to nitrate and to elementary nitrogen. He has isolated and studied an organism to which he gives the name *Bacillus nitrator*, which oxidizes ammonia directly to nitrate without the intermediate formation of nitrite. The most efficient medium for isolating this organism was found to be a solution containing 1/20,000 of formaldehyde in addition to the usual nutritive substance. He has also isolated and described the action of an organism, for which he proposes the name *B. azotofluorescens*, which oxidizes ammonia, setting free elementary nitrogen without the intermediate formation of either nitrite or nitrate. This organism was easily isolated from culture solutions containing formaldehyde or sodium formate.

The author gives a chemical reaction to show the possibility of the oxidation of elementary nitrogen, and expresses the opinion that very probably there is an organism which can bring about such oxidation. The author's preliminary experiments indicate that the conditions are more favorable for such oxidation in heavy clay and calcareous soils than in light soils.

Apparatus for the preparation of lime nitrogen and ammonium sulphate by the processes of the Cyanid Company of Berlin (*Österr. Chem. Ztg., 9 (1906), No. 24, pp. 328–330, figs. 4*).—The descriptions and illustrations given in this article are taken from a report on nitrogen fixation and lime nitrogen by G. Erlwein. (See also E. S. R., 18, p. 916.)

The changes and the decomposition products of lime nitrogen in soils, H. KAPPEN (*Fühling's Landw. Ztg., 56 (1907), No. 4, pp. 122–127*).—The rate of transformation into ammonia of lime nitrogen (at ordinary temperature, at 40° C., and in an atmosphere of carbon dioxid), pure calcium cyanamid, dicyanamid, and cyanamido carbonate of lime, in loam and sandy soils and in glass sand was studied with a view especially to its bearing upon the injurious effects of lime nitrogen when applied as a top-dressing. The transformation of lime nitrogen at ordinary temperature and in an atmosphere of carbon dioxid was very rapid and was practically complete at the end of 23 days in loam soil. In no case was more than a very small percentage of the dicyanamid transformed. The transformation of lime nitrogen at 40° C. was 94.28 per cent in loam, 18.75 in sandy soil, and only 2.81 per cent in glass sand. The other products showed lower rates of transformation, but these were highest in the loam soil and lowest in the glass sand.

These experiments are a continuation of those by Immendorff and the author which indicated that the first poisonous effects observed when lime nitrogen was applied as a top-dressing on acid soils are due to cyanamid, the later effects to dicyanamid.

Experiments with lime nitrogen as a fertilizer, B. SCHULZE (*Fühling's Landw. Ztg., 56 (1907), No. 5, pp. 145–159*).—Series of pot experiments are reported (1) with barley, oats, mustard, spurry, buckwheat, and carrots to determine the relative efficiency of lime nitrogen, nitrate of soda, and sulphate of ammonia on these crops under different cultural conditions; (2) to determine whether the full efficiency of lime nitrogen is obtained by winter applications; (3) with oats followed by mustard to determine the influence of the depth of

application on the efficiency of the lime nitrogen; and (4) to determine the effect of top-dressing with lime nitrogen.

The relative efficiency of the nitrogenous materials on the basis of the increased yield produced, taking nitrate of soda as 100, was 91 in case of sulphate of ammonia and 86 in case of lime nitrogen for all of the crops except buckwheat, with which the efficiency of the sulphate of ammonia was 100 and of the lime nitrogen 77. On the basis of the utilization of the nitrogen, the relative efficiency of the 3 materials was nitrate of soda 75, sulphate of ammonia 58.1, and lime nitrogen 46.6.

The results indicate that there is a considerable loss of nitrogen from lime nitrogen when the material is applied in the winter. The best results were obtained by incorporating the lime nitrogen with the soil to a depth of at least 25 cm. Decidedly injurious effects were observed when the material was used as a top-dressing or mixed with the soil to a shallow depth.

Culture experiments with synthetic nitrate of lime, T. Schloesing, Jr. (*Bul. Soc. Nat. Agr. France, 66 (1906), No. 9, pp. 727–731; abs. in Rev. Gén. Agron., n. ser., 2 (1907), No. 1, pp. 9–11*).—Experiments in different parts of France with the product manufactured by the electrical process at Notodden. Norway, are reported. The basic nitrate of lime was compared with nitrite and nitrate of lime and nitrate of soda on wheat, oats, potatoes, hay, and grapes on a variety of soils. In general the different fertilizers were about equally effective.

Experiments with nitrogenous fertilizers at the Halle experiment station during 1905 and 1906, Schneidewind (*Landw. Wchnschr. Sachsen, 9 (1907), No. 9, pp. 87–89; Mitt. Deut. Landw. Gesell., 22 (1907), No. 5, pp. 36–39*).—A large number of comparative plat tests of nitrate of soda, sulphate of ammonia, and lime nitrogen on barley, rye, wheat, potatoes, and sugar beets on 4 typical soils are reported. The relative efficiency of the nitrogenous fertilizers on 3 of these crops, taking nitrate of soda as 100, was as follows: Barley—sulphate of ammonia 92, lime nitrogen 77; potatoes—sulphate of ammonia 99, lime nitrogen 95; sugar beets—sulphate of ammonia 95, lime nitrogen 72; or, averages for all 3 crops of 95 for sulphate of ammonia and 81 for lime nitrogen.

The influence of applications of lime and magnesia on phosphate fertilizing, F. Westhausser and W. Zielstorff (*Landw. Vers. Stat., 65 (1907), No. 5–6, pp. 441–447; abs. in Jour. Chem. Soc. [London], 92 (1907), No. 534, II, p. 296*).—A series of experiments on mustard grown in zinc pots containing 6.5 kg. of ordinary field soil poor in plant food, especially lime and magnesia, to which phosphoric acid in water-soluble form was applied at rates of 50 and 100 kg. per hectare, and Thomas slag at the rate of 100 kg. per hectare, is reported. All of the pots received a basal fertilizer of sodium nitrate and potash salts, and in different cases calcium carbonate, magnesium carbonate (separately or in mixture), gypsum, caustic lime, and caustic magnesia were also applied in varying amounts with the other fertilizers. All of the lime and magnesia compounds except gypsum reduced the yield when used in connection with soluble phosphate, even when the latter was used at the rate of 100 kg. per hectare. The injurious effect was more marked in the case of magnesia compounds than in case of lime compounds. In the case of Thomas slag the addition of moderate amounts of lime or magnesia compounds increased the yield in every case. Large applications of lime and especially magnesia reduced the efficiency of the slag.

The value of crude ammonia, M. de Molinari and O. Ligot (*Bul. Agr. [Brussels], 23 (1907), No. 2, pp. 172–174*).—In continuation of previous work (E. S. R., 18, p. 621) the authors report examinations of 6 samples of crude ammonia from different sources. In these the ammoniacal nitrogen varied from

0.42 to 2.28 per cent, the organic nitrogen soluble in water from 0.21 to 1.96 per cent, the organic nitrogen insoluble in water from 1.78 to 7.24 per cent, and the total nitrogen from 5.01 to 9.98 per cent. It is pointed out that in view of these wide variations in composition this material should be bought only upon analysis.

Fertilization of cane lands, F. B. CARPENTER (*La. Planter, 38 (1907), No. 7, pp. 109, 110*).—This is a paper which was read before the Louisiana Sugar Planters' Association, discussing the soil and fertilizer requirements of sugar cane, the best sources of plant food, and the best methods of mixing and applying fertilizers for this crop. The following general formula is recommended: Available phosphoric acid 6 to 7 per cent, nitrogen 5 to 6 per cent, potash 3 to 4 per cent. "The materials, especially the nitrogen, should be selected so as to give the growing crop a continuous supply of plant food and also to avoid danger of large losses by heavy rainfalls."

Report of the State chemist of Florida, 1905 and 1906, R. E. ROSE (*Bul. Fla. Agr. Dept., 17 (1907), No. 1, pp. 124*).—This report deals mainly with fertilizer and feeding-stuffs inspection and the fertilizer industry in the State, but also discusses the preparation of insecticides and fungicides, the manufacture of cane sirup in the South, the production of Sumatra and Havana tobacco, the need of a pure-food law, and the importance of developing farmers' institutes and agricultural and technical education in the State.

The analyses made during the year include 239 official samples of fertilizers, 231 samples of special fertilizers, 160 official samples of feeding stuffs, 37 special samples of feeding stuffs, and 135 samples of miscellaneous materials (waters, minerals, soils, etc.). Of the 239 official samples of fertilizers the average composition was, ammonia 3.89 per cent, available phosphoric acid 6.47 per cent, and potash 7.85 per cent, these percentages in every case being slightly above the average guaranteed analyses. A number of formulas for fertilizer mixtures for vegetables and for cotton are given.

Fertilizer analyses, A. J. PATTEN and DOROTHEA MOXNESS (*Michigan Sta. Bul. 239, pp. 15*).—Analyses of 134 brands representing the product of 21 firms are reported.

Commercial fertilizers, J. L. HILLS and C. H. JONES (*Vermont Sta. Bul. 126, pp. 17–40*).—Analyses and valuations of samples representing 57 brands are reported.

AGRICULTURAL BOTANY.

Seeds and plants imported during the period from December, 1903, to December, 1905. Inventory No. 11, A. J. PIETERS (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 97, pp. 255*).—This inventory of seeds and plants imported by the Bureau of Plant Industry for experimental purposes covers the period from December, 1903, to December, 1905, and embraces nearly 7,000 items. It represents the collections of H. L. Bolley, E. A. Bessey, L. R. Jones, T. H. Kearney, and others, and gives not only the names of the new introductions, but also embodies notes made at the time of the collection by the agricultural explorers.

The relation of temperature and humidity to the germination of seed of certain grasses, C. DENEUMOSTIER (*Bul. Agr. [Brussels], 22 (1906), No. 7, pp. 983–998*).—Studies were made to determine the optimum temperatures and moistures for the germination of the seed of Italian and perennial rye grass, meadow fescue, tall oat grass, timothy, crested dogtail grass, and velvet grass.

For the rye grasses, meadow fescue, and tall oat grass the germination bed

should be kept at not less than 60 per cent of saturation, while for timothy, crested dogtail, and velvet grass it should in no case exceed 60 per cent of saturation. A constant temperature of about 25° C. gave the best results for the rye grasses, timothy, and velvet grass, while for the others a variable temperature of 18 hours at 25° C. and 6 hours at 30° C. proved best.

The influence of sea water on the germination of seed, S. BIRGER (*Bot. Centbl., Beihefte, 21* (*1907*), *1. Abt., No. 3, pp. 263–280*).—In studying the distribution of plants by means of ocean currents, the author was led to carry on some experiments to test the effect of sea water on the germination of the seed of 27 species of Scandinavian plants. Equal lots of seed were subjected for 30 days to sea water containing 3.4 per cent of salt, to fresh water, and similar lots were placed to germinate between filter papers moistened with tap water.

With many species the sea water destroyed the vitality of the seed, while with others it had little or no effect. In some instances more seed germinated after being in sea water for 30 days than when in fresh water for a like period, and some gave even higher percentages than when germinated directly between the filter papers. The effect of the salt water depends upon its osmotic action, which in turn is limited by the structure of the seed coats. It appears that sea water may possibly exert some influence on the enzyms in the seeds.

A tabular list is given showing the results of several investigators along the line of experiments indicated.

The germination of orchids, N. BERNARD (*Report of the Third International Conference, 1906, on Genetics. London: Roy. Hort. Soc., 1907, pp. 392–396, fig. 1*).—The author gives an account of his investigations on the germination of orchid seed, which seem to indicate that there is a close connection between the germination of the seed of orchids and the species of fungi associated with them. The fungi are capable of living apart from the roots of the plants, but the orchids do not seem to develop except in the presence of the fungi. This was shown by experiments in which the seeds of a number of orchids were aseptically treated, placed in sterilized tubes with a nutritive solution, and kept for months in suitable conditions of light and temperature. Under these conditions the seeds become swollen and later they assume a green color, but their growth remains insignificant. On the other hand, if the proper fungi are sown with the seeds the germination begins almost immediately and proceeds in the regular manner.

The author believes that orchids are by no means the only plants which are benefited by some such association with fungi.

The cross inoculation of Leguminosæ and other root-tubercle bearing plants, W. B. BOTTOMLEY (*Rpt. Brit. Assoc. Adv. Sci., 1906, pp. 752, 753*).—A brief account is given of experiments conducted to test the possibility of cross inoculation between the organisms found in the root tubercles of acacia, alder, elæagnus, and various Leguminosæ. The acacia tubercles were obtained direct from wattles from Western Australia, the other material being from the Botanic Gardens, Regent's Park. The nodules were sterilized, cut under sterile conditions, and small portions transferred to nitrogen-free cultures. After incubation for several days, the material was used to inoculate pots of sweet peas and tares which were growing in sterilized sand. At the end of 4 weeks' growth the plants were examined and it was found that every plant in the inoculated set bore tubercles, while not a single one was found on the uninoculated plants.

The formation of slime or gum by Rhizobium leguminosarum, R. G. SMITH (*Proc. Linn. Soc. N. S. Wales, 31* (*1907*), *pt. 2, pp. 264–294*).—The production of slime by *R. leguminosarum* under certain conditions of cultivation

has been noticed by many investigators, and the presence of this slime is considered a normal function of the organism.

The author has studied a number of races of this organism from plants of various kinds. He has found that slime is formed by a majority of the races upon solid media, and that, as a rule, for its formation the presence of sugar and a source of nitrogen are required. Some races of organisms were found to produce slime, while others did not. The most suitable sources of nitrogen were asparagin and nitrates, and, as a rule, an optimum temperature of 22° C. is to be preferred, although with a race obtained from the black locust the optimum was 26° C.

The experiments on the physiological activities of the various races of the micro-organism showed that after their isolation from the root nodules they all differed. With regard to the function of the micro-organism in the nodule there is said to be strong evidence that it is to produce slime which may be closely related to the carbohydrates of the nucleoproteid molecule. The slime in all likelihood is partially utilized in the formation of the nodules. There is in this respect a true symbiosis so far as the nodules are concerned. The slime may also be transported to other parts of the plant where it is utilized, but there is no evidence to show that the albuminoids of the micro-organisms are utilized by the growing plant, as the majority of them still retain their chromatin. The formation of slime was found proportional to the nitrogen supplied, and there appeared to be no fixation of nitrogen in pure cultures.

The inconsistency of the results hitherto obtained in the inoculation of leguminous crops with bacterial cultures is believed by the author to be due partly at least to the fact that the slime-forming function of the micro-organism had not been recognized and races incapable of slime formation had been used.

The structure of Rhizobium leguminosarum, R. G. SMITH (*Proc. Linn. Soc. N. S. Wales, 31 (1907), pt. 2, pp. 295–302, pls. 2*).—In a previous publication (E. S. R., 12, p. 314) the author concluded from his studies of *R. leguminosarum* that it was a form of yeast, but subsequent studies have led him to the conclusion that it is a compound micro-organism and consists of cocci, micrococci, or diplococci, the chromatin of which may be swollen or condensed within a tubular, straight, or branching rod or capsule. Since the Rhizobium cell is a tubular capsule containing spherules it is easy to understand that by an increase in the number of these spherules the cell may become misshapen, and irregular forms, such as T, Y, and other shapes, be produced.

The distribution of prussic acid in the vegetable kingdom, M. GRESHOFF (*Rpt. Brit. Assoc. Adv. Sci., 1906, pp. 138–144*).—In a paper presented before this association, an abstract of which has already been noted (E. S. R., 18, p. 729), a list is given of species of plants in which hydrocyanic acid is known to occur, and the synthesis and function of hydrocyanic acid are discussed.

The author recognizes 2 forms under which hydrocyanic acid occurs in plants, one in combination with acetone and the other with benzaldehyde. In the Rosaceæ and many other plants the hydrocyanic acid is said to occur in the latter form, and by many physiologists it is believed to have nothing to do with the breaking down or building up of proteids, but that this substance is formed by the plant from sugar and nitrates for its defense. On the other hand, those who have studied the occurrence of hydrocyanic acid in *Pangium edule* and other tropical plants are inclined to agree with Treub that it is a stage in the normal formation of proteids in plants.

The chemical aspects of cyanogenesis in plants, W. DUNSTAN and T. A. HENRY (*Rpt. Brit. Assoc. Adv. Sci., 1906, pp. 145–157*).—It is said that while in all plants in which cyanogenesis has been investigated some free hydrocyanic acid may exist, there is always present a cyanogenetic glucosid which is

readily decomposed by an associated enzym yielding acid. A number of these glucosids are mentioned and their chemical formulas and reactions are given. Among those described are amygdalin, mandelic nitrile glucosid, sambunigrin, prulaurasin, dhurrin, lotusin, phaseolunatin, etc. Among the enzyms associated with these glucosids the authors briefly characterize emulsin, lotase, gynocardase, and maltase. The physiological significance of cyanogenesis is discussed at considerable length.

The translocation of essential oils, E. CHARABOT and G. LALOUE (*Compt. Rend. Acad. Sci. [Paris], 144 (1907), No. 15, pp. 808-810*).—A study was made of *Verbena triphylla* to determine the translocation of the essential oils due to differences in the age of the plants.

Fifty plants at the beginning of flowering were subjected to distillation, the essential oil from the roots, stems, leaves, and inflorescences being collected separately. An average of 337 mg. of essential oil for each plant was obtained, distributed in the different parts as follows: Roots 10 mg., stems 8 mg., leaves 242 mg., inflorescences 77 mg. A few weeks later, after flowering had ceased, a similar lot of plants was examined, and the amount of essential oil found was 280 mg. per plant, of which 16 mg. occurred in the roots, 16 mg. in the stems, 192 mg. in the leaves, and 56 mg. in the inflorescences. During the period of about 3 weeks there had been a considerable translocation of essential oil, as shown by the increase in the roots and stems, but a total loss of 57 mg., which loss is attributed to the utilization by the plant of the essential oils in ripening its fruit.

The weeds of the Province of Prince Edward Island, W. LOCHHEAD (*Prince Edward Isl. Agr. Rpt., 3 (1906), App., pp. I-XXVII, pls. 18*).—Illustrated descriptive notes are given on a number of the more troublesome weeds, with suggestions for their eradication.

FIELD CROPS.

Annual report of the Porto Rico Experiment Station for 1906 [Field crops], D. W. MAY (*Porto Rico Sta. Rpt. 1906, pp. 5-17*).—The progress made in the culture of tobacco, coffee, sugar cane, cotton, rice, forage crops, and fiber plants at the station and in the island are briefly described. The possibilities of a profitable production of these crops in the island, their requirements, and the present state of their culture are discussed.

Demonstration farms, E. G. SCHOLLANDER (*North Dakota Sta. Rpt. 1906, pt. 1, pp. 66-89*).—This report maps out the work for a period of 5 years and gives the results obtained the first season on 6 demonstration farms in the State. The object of the work is to determine in each case what crop rotation is best adapted to that particular neighborhood, to build up the fertility of the soil by substituting field corn and clover for summer fallowing, and to preserve the moisture and clean the land by extra tillage.

The results of soil moisture determinations and the rainfall and frost records at different points are given in tables.

Crop work at the northern substation farms, R. A. MOORE and E. J. DELWICHE (*Wisconsin Sta. Rpt. 1906, pp. 275-280, figs. 3*).—Swedish Select oats at Iron River yielded 27 bu. per acre, weighing 38.6 lbs. per measured bushel, and barley 26 bu., weighing 49.2 lbs. Corn was fully matured before October 5, before heavy frost, and gave a total yield of 18,500 lbs. per acre, the grain amounting to 47.7 bu. of shelled corn. An early variety of soy beans produced 2 tons per acre of well-cured hay, and a row left in the field produced a good quality of well-ripened beans before frost. One-fourth acre of Kleinwanzleben sugar beets yielded at the rate of 9 tons per acre, and showed a test of 93.3 in

purity and 16.9 in sugar content. At Ashland, Swedish Select oats yielded 16 bu., weighing 30 lbs. per bushel, and at Superior 9 bu. per acre, also weighing 30 lbs. per bushel. The yield of barley at Ashland was 16.5 bu., with the weight per bushel 49.2 lbs.

Report of experimental work on the Randolph County farm, 1906, G. I. CHRISTIE (*Indiana Sta. Circ. 5, pp. 4*).—This is a report on the work conducted at the Randolph County farm, recently established as a county farm experiment station.

Twenty-eight varieties of corn were under test. The results of the first year suggest that the farmers of the county possess some valuable strains of varieties of corn for their locality, that imported varieties do not prove as satisfactory as home-grown varieties, and that many farmers are growing strains or varieties not of the highest producing power.

Field experiments, A. R. WHITSON, E. J. DELWICHE, and E. R. JONES (*Wisconsin Sta. Rpt. 1906, pp. 181–200, figs. 3*).—Soil improvement experiments are in progress on sandy, marshy, and red clay soils.

On sandy soil, at Sparta, the best crop of oats was secured where either barnyard manure or peat, potash, and acid phosphate was applied. The results indicate that the chief lack in the soil for this crop is nitrogen. Peat, with phosphoric acid and potash, was not equivalent to barnyard manure in growing corn. A yield of 38.7 bu. per acre was obtained on the manured plat, while the check plat yielded only 7 bu. For potatoes the effect of the fertilizers applied was similar to that with corn, with the exception that peat did not seem so beneficial. The application of phosphoric acid and potash is considered of little use on this soil until its nitrogen content has been increased.

The chief problem on the field at Iron River, as on that at Sparta, is the retention of a sufficient supply of humus to give the soil a good water-holding capacity. The largest yield of marketable potatoes was secured on the plat receiving peat, phosphoric acid, and potash, and the smallest yield on the plat receiving no fertilizers. The yield of corn on the different plats varied from 28.3 bu. to 51.5 bu. per acre, but the variation in the natural fertility of the field makes the yields on the different plats of little value. The effect of peat and manure on oats was very noticeable.

In reclamation work on marshy soils at Marinette it was found that phosphoric acid is the element most needed, and that potash is also beneficial.

Notes are also given on cultural work carried on at different points. On the red clay lands near Superior the best stand and the best yield of corn was obtained where tile had been placed 40 ft. apart. Larger distances between tile lines gave less satisfactory results.

Experiments with grains and forage plants, 1906, R. A. MOORE and A. L. STONE (*Wisconsin Sta. Rpt. 1906, pp. 240–258, figs. 3*).—Of 27 varieties of oats under test Sixty Day and Kherson, which gave good results last season, again produced good yields. The Sixty Day showed its characteristic earliness, but was weak and lodged badly. Swedish Select continues to give good yields and to prove most satisfactory on high and lighter soils.

Sixty-four varieties of barley were compared at the station this season, and a cooperative test of Oderbruck barley was carried on by members of the Wisconsin Experiment Association. At the station the beardless, hulless, and 2-rowed barleys showed weakness of straw and did not fill out well. The best yields of grain were produced by Silver King, Manshury, and Oderbruck, the yields being 61.3, 60.6, and 60.1 bu. per acre, respectively. These 3 varieties matured in 98 days.

In the cooperative test with Oderbruck barley an average yield of 41.8 bu. per acre was secured on fall plowing, and 35.9 bu. on spring plowing. Drilling

gave an average yield of 41.1 bu., as compared with 39.6 bu. where sown with a seeder. Drilling on fall plowing gave an average yield of 43.3 bu., and on spring plowing 37.3 bu., as compared with 41.2 bu. and 35 bu., respectively, where a seeder was used. In 4 cases where the barley was sown on land not plowed, but worked up carefully with a disk plow, an average yield of 22.2 bu. was secured.

The row test of Wisconsin No. 7 corn, begun in 1905, showed that the yields of seed corn and marketable corn had been materially increased over those of a year ago. The average yield per row in 1905 was, seed corn 22.6 lbs., marketable corn 97 lbs., and nubbins 7.2 lbs.; and in 1906, seed corn 53.1 lbs., marketable corn 132.8 lbs., and nubbins 13 lbs. In 1906 the average yield per acre on 4 10-row plats was 75 bu. While the heavy yield was largely due to a favorable season, it was noticed that the increase of seed corn was greater in proportion than that of the nubbins, and this fact is considered due to the selection of seed.

For 2 years seed has been selected from stalks bearing a single large ear and compared with seed from stalks bearing 2 good ears. The results at present show a decrease in the weight of single ears in one case and an increase in the other, with a similar result in the double-ear strain. The total yield of corn was greater where the selection was made to increase the number of single ears than where it was made to increase the number of double ears. The total yield from the single-ear strain was 1,324 lbs. of corn from 8 rows each 396 ft. long, and 1,197 lbs. from the double-ear stalks. Generally the double-ear stalks produced small and poorly formed ears.

Of the crosses made in 1905 that of Wisconsin No. 8 on Toole North Star was most promising, and the crop of this cross during 1906 seemed to show that this new variety has a larger ear than the Wisconsin No. 8 and ripens earlier than North Star. The corn was ripe and cut September 26, 126 days after planting, while in 1905 the ripening period of Wisconsin No. 8 was 120 days and of North Star 133 days.

An experiment in summer seeding of alfalfa was begun in 1905. The alfalfa was sown without a nurse crop on July 14 and August 12. The next season, while 1.5 tons of field-cured hay per acre was secured on the July seeding, both plats were too weedy to be successful and were plowed up and sown to winter grains. The following season alfalfa was sown on April 23 and 24 with barley as a nurse crop, on May 11 without a nurse crop, and on June 1 on ground that had been kept free from weeds by cultivation during the season. The best stand was secured by seeding in April with a nurse crop. As determined from members of the Wisconsin Experiment Association, clover and alfalfa were badly winterkilled in the southern half of Wisconsin during the winter of 1906. In the northern part of the State the crops were protected by snow and suffered little. Alfalfa proved to be as hardy as medium red clover.

Brief notes are given on different plant-breeding experiments in progress.

Report of the chemist [Field crops], C. L. PENNY (*Delaware Sta. Rpt. 1903, pp. 97–112*).—*Cover crops.*—A study of various cover crops was made and the yield and composition of the portion of the crops above ground and of the roots is tabulated, together with their money valuation as green manures. Data with reference to the moisture content of the surface soil under the different crops are also given.

The soy bean furnished the greatest weight of air-dry matter in the tops alone, and the cow-horn turnip the greatest air-dry weight of roots. In the yield of tops and roots the soy bean ranked highest with 3¾ tons per acre, being followed by rape with a little over 3 tons, crimson clover and cow-horn turnip with a little less than 3 tons, alfalfa, red clover, and cowpeas with about

2 tons each, and vetch with about 1¾ tons per acre. The soy bean produced a total yield of nitrogen of about 140 lbs. per acre, being closely followed by crimson clover, rape, and vetch, while the cowpea gave 69 lbs. per acre, or about half as much as the soy bean.

By rating the nitrogen at 12 cts., the potash at 5 cts., and the phosphoric acid at 3 cts. per pound, the money value per acre of these constituents for the best 8 cover crops ranged from $17.90 for red clover to $25.84 for rye and vetch, the average being $21.48. Of this average value the nitrogen represented $15.21, the potash $5.13, and the phosphoric acid $1.14, being 71, 24, and 5 per cent of the whole value, respectively. In crimson clover, which has the most phosphoric acid relatively and absolutely, this constituent represented only 8 per cent of the whole value. The highest potash value, $8.07 per acre, was found in the rape, where it constituted 32 per cent of the whole. The cow-horn turnip with $7.14, and rye and vetch with $6.76 for potash, stood next, but in each of these this element constituted 34 per cent of the whole.

Soil moisture determinations were made on plowed and unplowed soil. On an average for the season the unplowed land contained 3.7 per cent less moisture than the plowed soil. During the autumn and winter months the subsoil of the plowed portion contained on an average 3.7 per cent more moisture than the unplowed portion.

Selective propagation of corn.—Analyses were made of 335 ears of seed corn secured throughout the State, and it was found that the protein content ranged from 8.31 to 11.31 per cent. Directions for the selection of seed corn are given.

Crop production in western Nebraska, W. P. SNYDER and E. A. BURNETT (*Nebraska Sta. Bul. 95, pp. 34, figs. 8*).—This bulletin contains a description of the substation at North Platte, together with a report of the results obtained with different kinds of crops. The requirements of dry-land farming are also outlined.

Of a number of durum wheats grown, Black Don and Velvet Don have given the highest yields. In variety tests of 3 years the highest yielding durum wheat gave an average yield per acre of 18.5 bu., and the lowest of 13.9 bu., while the common spring wheat yielded 7.2 bu. The average yield per acre during the 3 years was with durum varieties 2⅓ times that of the common spring wheat. The results of winter wheat tests showed that Kharkof outranked Turkey Red in yield. It was observed that it is advisable to sow winter wheat before September 15. Seeding 2 pk. per acre gave practically the same yield as seeding 4 or 5 pk.

In 1906, Sixty Day oats yielded 47.8 bu. and Kherson 47 bu. per acre, but the results of all tests made during 3 years placed Kherson first and Sixty Day and Texas Red a close second and third, respectively. The highest yield of oats secured at the substation was 52 bu. per acre on a 5-acre tract, but yields of 75 and 80 bu. are reported by farmers growing Kherson oats from seed secured at the substation.

Beldi and Telli barley, 2 Algerian varieties, did not yield as well as common bearded barley, which on 1 plat produced 44.4 bu. per acre, as compared with 29.4 bu. for hulless and 17.8 bu. for beardless. Emmer did not appear to yield as heavily as barley.

The average yields of different varieties of corn grown for 2 years ranged from 39.8 bu. for Pride of the North to 45.9 bu. for Silver Mine. Calico, yielding 45.6 bu. per acre, is considered the best corn tested. This variety and Pride of the North matured fully.

The results with different annual forage crops are also briefly noted. The highest average yields for 2 years from cane, Kafir, and milo were secured when

these crops were drilled in double rows 7 in. apart, with each pair of rows 35 in. from the next pair. Cane and Kafir produced about equal quantities of excellent forage. Dwarf milo also gave good results, but showed no advantage over cane, with the exception that the seed is perhaps better for feed. German and Siberian millet yielded only about one-half as much per acre as cane, which, with the exclusion of alfalfa, is considered the main forage crop for western Nebraska. The yield of seed on 3 plats of brome grass ranged from 157 to 700 lbs. per acre. The heaviest yielding plat had been in alfalfa previous to being seeded to brome grass. Directions for sowing brome grass are presented in detail.

The experience with alfalfa at the station and in its vicinity is given, together with notes on its culture especially for seed.

Principles of tillage and rotation, W. H. DAY (*Ontario Dept. Agr. Bul. 156, pp. 8*).—This bulletin discusses tillage in relation to soil moisture and considers, in addition, the necessity of the proper conditions in soil temperature, air supply, and the sanitary environment of the roots of the plants.

Pot experiments were conducted to determine the water requirements of different crops. In 1905, a season with ordinary rainfall, wheat required 22.60, peas 27.38, barley 18.52, and oats 21.15 in. of water, and in 1906, a wet season, wheat used 17.32, peas 18.32, barley 18.82, and oats 18.47 in. of water. It is concluded that during a wet season crops do not use as much water as during a dry one, although the supply is much more abundant. In these experiments during the wet season the crops required one-half more than the rainfall, and it is pointed out that any soil, whatever its condition, retains enough of the spring and winter precipitation to supply this deficiency.

A loam soil was allowed to dry out until the grain growing in it began to wilt. The water content of this soil at the wilting point was found to be 7.3 per cent.

Forage crops of high, medium, and low protein content, H. SNYDER (*Minnesota Sta. Bul. 101, pp. 229–256*).—The protein content and the composition of the dry matter of a list of forage crops and forage-crop combinations are given and briefly discussed. The dry matter and protein content of corn fodder at different stages of growth are shown in a table, as is also the composition of silage and that of corn smut.

It was found that corn fodder, timothy hay, rape, pasture grass, and hay crops from mixed grasses were materially influenced in composition by the use of farm manures. Less fiber and from 25 to 30 per cent more protein were secured on soils in a good state of fertility than on similar soils low in plant food. Leguminous crops like clover, alfalfa, and peas did not appear to be as susceptible to the influence of fertilizers in increasing the protein content as crops like corn fodder and rape.

An examination of a number of samples of clover, alfalfa, pea, bean, and millet seeds of known quality showed each sample to contain 2 distinct types of seed, 1 of high and the other of low protein content. The high protein seeds were darker in color and more corneous in character than the low protein seeds. It is believed that by selecting seeds on this basis, forage crops of the maximum protein content may be produced in the same way as has been accomplished with wheat and corn.

Analyses of 18 samples of the more common weeds showed that many of them assimilate large amounts of soil nitrogen, and it was found that when they were harvested with grain crops the amount of nitrogen removed by them from the soil was often larger than that contained in the grain.

The dry matter of nearly matured rape was found to contain about the same amount of protein as clover. Rye fodder, prairie hay, and millet showed about the same general composition in feeding value as timothy hay produced under

similar conditions and cut at the same stage of growth. Pasture grass and hay from mixed grass seeds and some clover contained more nutrients, especially when grown on well cultivated and manured land, than timothy, red top, or blue grass alone.

A comparison of methods for the inoculation of leguminous crops, R. A. MOORE and E. J. HASTINGS (*Wisconsin Sta. Rpt. 1906, pp. 281–284*).—The methods employed are outlined, and the nature and origin of the cultures used are described. The use of artificial cultures for the production of nodules upon soy beans and alfalfa was not successful, while the inoculation of these crops with infected soil produced nodules in abundance the first year.

The vitality, adulteration, and impurities of clover, alfalfa, and timothy seed for sale in Iowa in 1906, L. H. PAMMEL, R. E. BUCHANAN, and CHARLOTTE M. KING (*Iowa Sta. Bul. 88, pp. 69, figs. 39, maps 2*).—Earlier work of this kind at the station and elsewhere is briefly reviewed and the results of investigations with clover, alfalfa, and timothy seed are reported.

In 130 samples of red clover seed the percentage of impurities was determined by weight and averaged 1.93 per cent. The highest percentage of impurities was 33.3 and only 2 samples consisted of pure seed. Of 118 unweighed samples of red clover seed, 76 were found to contain yellow foxtail (*Setaria glauca*), 68 timothy (*Phleum pratense*), 61 curled dock (*Rumex crispus*), 57 green foxtail (*Setaria viridis*), 48 lady's thumb (*Polygonum persicaria*), 46 rib grass (*Plantago lanceolata*), 46 Rugel plantain (*Plantago rugelii*), 37 rough pigweed (*Amarantus retroflexus*), 34 sheep's sorrel (*Rumex acetosella*), 34 crab grass (*Panicum sanguinale*), 30 dooryard plantain (*Plantago major*), 25 lamb's quarter (*Chenopodium album*), and 20 bracted plantain (*Plantago aristata*). Other weeds occurred in a smaller number of samples, and sand was found in 37 samples.

Of a total of 248 samples of clover seed, 98 contained rib grass, 35 bracted plantain, 21 Canada thistle, and 10 dodder. Five typical poor samples of clover seed contained 10.301 per cent of impurities, and 5 typical good samples 0.096 per cent.

The principal impurities found in white clover seed were sheep's sorrel, Rugel plantain, bracted plantain, timothy, curled dock, lamb's quarter, blue grass (*Poa pratensis*), and cinquefoil (Potentilla).

In 31 weighed samples of alsike clover seed, the impurities amounted to 3.437 per cent, and of 19 unweighed samples 18 contained timothy and 11 sheep's sorrel. Of 10 samples of alfalfa seed examined, 8 contained rib grass. A study of 24 samples of timothy showed that none of the weed seeds they contained were other than those of species common in Iowa. In a second lot of 30 samples examined, 20 contained sand and 15 red clover.

The following average results were secured in germination tests: Red clover tested in March, plump seeds 79.8 per cent, shrunken seeds 30.9 per cent; red clover tested in November, plump seeds 48.62 per cent, shrunken seeds 25.23 per cent; mammoth clover, plump seeds 72 per cent, shrunken seeds 71 per cent; medium red clover, plump seeds 87.61 per cent, shrunken seeds 46.88 per cent; alfalfa tested in March, plump seeds 56.91 per cent, shrunken seeds 24.16 per cent; alfalfa tested in November, plump seeds 20 per cent, shrunken seeds 10 per cent; timothy, plump seeds 64 per cent, shrunken seeds 20.7 per cent.

A general discussion of the impurities found in agricultural seeds and an alphabetical list of all impurities found in the samples examined in these investigations are given.

Soy beans, cowpeas, and other forage crops, A. T. WIANCKO and M. L. FISHER (*Indiana Sta. Bul. 120, pp. 439–460, figs. 6*).—Historical notes on the soy bean and cowpea are given, the uses, value, culture, and cost of production

discussed, and a number of varieties of the 2 crops described. Notes are also given on a number of miscellaneous forage crops.

The best average yield of soy beans, 21.3 bu. per acre for 3 years, was secured from planting 24 lbs. of seed per acre in drills 32 in. apart and cultivating the crop. A plat broadcasted at the rate of 1½ bu. of seed per acre gave an average yield for the 3 years of only 10.7 bu. The common wheat drill was found the most convenient and most satisfactory machine for planting both soy beans and cowpeas, and detailed directions for its use in this connection are given.

The earliest variety of soy beans, Very Dwarf Brown, ripened about August 19, and the latest, Medium Early Yellow, about October 21. The late varieties gave as a rule heavier yields than the early maturing sorts. The largest average yield, 22.2 bu. per acre, was secured from Medium Green, and the smallest, 9.5 bu., from Very Dwarf Brown.

Among the varieties of cowpeas grown for forage in 1905, the highest average yield, 7,600 lbs. of hay per acre, was secured from Clay 13458, followed by Iron with a yield of 7,400 lbs. per acre.

In connection with a description of a number of miscellaneous forage plants, a succession of crops for soiling purposes is outlined.

Haymaking at Kenai Experiment Station, P. H. Ross (*Alaska Sta. Bul. 3, pp. 13, pl. 1*).—The experiments in making hay in 1905 and 1906 are briefly described. All cuttings were either oat hay or native hay (*Calamagrostis langsdorfii*), with the exception of 1 cutting of barley.

The author recommends cutting oats for hay when in the milk stage and the native grass when in full bloom. The hay should be stirred with a fork to leave it in a loosened condition shortly after cutting, so that the air will pass through it freely. Medium size, well-made cocks are advised so that the rains may do no damage and the curing process may go on. The shortest time in which hay was cured well was 10 days and the longest 25 days.

Alfalfa in Ohio, C. G. Williams and C. H. Kyle (*Ohio Sta. Bul. 181, pp. 111–135*).—The results with alfalfa at the experiment station and the experience of alfalfa growers throughout the State are reviewed.

It was found that upland clay and sandy first and second bottom lands have produced the heaviest maximum and average yields. All sandy upland and clay first and second bottom lands produced the lowest yields. Good yields and poor yields have been produced on all classes of soils, including muck. It was observed that the presence or absence of drainage, humus, limestone, and inoculation, and the degree of perfection of the seed bed, were usually the controlling factors in the growth of the crop. The yields on clay upland with natural surface drainage were 12 per cent greater where tiles were also used. Sandy soil or soil with a very poor subsoil is considered as usually not sufficiently retentive of moisture to insure certain results on upland. The soils which heaved the alfalfa were either poor in drainage or in humus, or in both combined.

The average yields from soils rich, fairly rich, and poor in humus were respectively 4.25, 3.75, and 3.33 tons per acre. At the station an alfalfa plat receiving 8 tons of manure per acre gave a yield of 10,275 lbs., or 1,347 lbs. per acre more than unfertilized plats. The use of lime on acid soils is recommended, and it is pointed out that fields on hillsides and upland usually become acid before those on bottoms. Inoculation with soil was found much better than inoculation with liquid cultures. It is stated that alfalfa may be seeded at any time after spring frosts are over until the middle of August, provided the seed bed is in proper condition.

Corn breeding and registration, C. G. Williams (*Ohio Sta. Circ. 66, pp. 14, dgms. 6*).—This circular contains a detailed description of growing seed corn

by the ear-row test plan, and presents the rules for the registration of seed corn with the Ohio Plant Breeders' Association.

The corn crop of Delaware, A. T. NEALE (*Delaware Sta. Rpt. 1903, pp. 7–34*).—This article presents some statistical studies based on census reports, discusses the significance of rain in corn culture, describes the beneficial effects which crimson clover may exert upon the corn crop, and gives practical details in the utilization of corn fodder.

It is believed that crimson clover on the land each winter, followed by corn each summer, improves the corn-producing qualities of the lighter lands in Kent and Sussex counties of the State, and that this is probably due to an increase in the water-holding power of the humus derived from the clover crop.

Hops in principal countries: Their supply, foreign trade, and consumption, with statistics of beer brewing, E. MERRITT (*U. S. Dept. Agr., Bur. Statis. Bul. 50, pp. 34, dgm. 1*).—This bulletin gives the production of hops in the United States from 1850–1900, and the annual production and commercial movement of this product from 1889–1905, together with the localization of the production in this and the European countries. Figures are also given with reference to the trade and consumption of hops in the United States and abroad. The countries producing a surplus, and those partially or wholly dependent upon foreign hops are enumerated, and the fluctuation in the price of hops is pointed out and discussed.

The data show that the United Kingdom, Germany, and the United States consume the most hops, and that Austria-Hungary, Germany, and the United States are the principal exporting countries. Germany imports from Austria-Hungary and the United States, while France, Belgium, and the Netherlands import from Germany. The United Kingdom supplies its demands from the United States, the Netherlands, Belgium, and Germany. Of the 4 principal hop-producing countries the largest yields per acre are obtained in the United Kingdom and the United States, and the best quality of product is secured in Austria-Hungary and Germany.

The United Kingdom and France require a much larger quantity of hops to the barrel of beer than Germany or other continental countries. The average for the United States is below that of the United Kingdom, Australia, and France, and above that of all other countries represented. The hops from countries where special attention is given to quality bring better prices and are held in higher esteem than American hops, even in our own country. The comparative trade, production, and consumption of hops in the principal countries for 1900–1904, and the yields, exports, and imports of the different countries for 1901–1905, together with the quantities of beer brewed in the different countries for 1890–1904, are given in tables.

Germany, the United States, and the United Kingdom are the 3 principal beer-producing countries of the world. Of the world's total beer production, Germany is represented by 27.8 per cent, the United States by 23 per cent, the United Kingdom by 22.6 per cent, Austria-Hungary by 8.5 per cent, Belgium by 6.1 per cent, and France by 5.7 per cent.

Duty of water on field peas, 1906, H. T. NOWELL (*Wyoming Sta. Bul. 72, pp. 16, figs. 13, dgm. 1*).—Field peas under the flood method of irrigation showed a wide variation in yield of dry forage and threshed peas, according to the quantity of water applied. On 6 plats the highest yield of dry forage, 4.2 tons per acre, was obtained with nearly 23 in. of water applied in 7 irrigations. The highest yield of peas, 34.75 bu. per acre, was secured when about 20 in. of water was applied in 4 irrigations. The yield decreased with either more or less water. The relation of cost of irrigation to the value of increased yield shows that a duty of water a little under 20 in. will probably give the

most profitable results. Each irrigation delays maturity, and when much over 20 in. of water is used at Laramie peas do not fully mature These results were obtained with a rainfall of 7.05 in. during the growing season.

A net profit of $50 per acre is possible by raising pea seed valued at 3 cts. per pound, and a net profit of $25 to $30 by raising forage for sale at $10 per ton, when the proper quantities of water are applied in several light irrigations.

Potato experiments, R. A. EMERSON (*Nebraska Sta. Bul. 97, pp. 26*).—During the past 2 years the station has carried on tests comparing various methods of potato culture, different sizes of seed pieces and quantities of seed, different kinds of seed, and distance experiments.

Seed potatoes produced under a straw mulch the preceding year yielded 47 per cent more in 1905 and 41 per cent more in 1906 than similar seed grown by cultivation. Seed potatoes stored in an ordinary cellar, where they wilted and sprouted badly before planting, gave poor results. The average yield from sound seed was 56 per cent greater than from sprouted seed in 3 separate tests. Of different combinations tried, the best results were obtained from 18 bu. of seed per acre cut in quarter tubers and the pieces planted 12 in. apart. Nearly as good results were obtained from 36 bu. per acre of seed tubers cut in halves and planted 12 in. apart.

An old alfalfa sod plowed up in the fall of 1905 and replowed in the spring seemed to have increased the yield of potatoes only 5 per cent. Planting the seed pieces in furrows made with a lister after plowing increased the yield 28 per cent, as compared with dropping the seed pieces in every third furrow as the plowing was done. Ridging up the ground over the rows of seed pieces when planted, and harrowing the ridges down as the weeds began to grow, increased the yield 53 per cent over leaving the ground level above the rows of planted seed.

Potatoes planted 4 in. deep gave better yields in 1905 than those planted 3 and 5 in. deep, but the tubers were about equal in quality. Planting the seed 1 and 2 in. deep decreased both yield and quality as compared with deeper plantings.

In 1905 7 cultivations gave 47 per cent greater yield than 5 cultivations, but 10 cultivations reduced the yield slightly below that from 7 cultivations. In 1906, from weedy lands, 3 harrowings followed by 4 cultivations produced a yield 132 per cent greater than 2 harrowings and 2 cultivations. The same year, on cleaner ground, 3 harrowings and 4 cultivations increased the yield over 2 harrowings and 3 cultivations by 60 per cent, while with 4 harrowings and 6 cultivations the yield was slightly decreased.

Seven years' experience indicates that mulching is a fairly satisfactory way of growing potatoes on a small scale, although the method is practicable only when the mulching material can be obtained very cheaply. Old hay or straw should be spread about 4 in. deep just before the plants appear and after the ground has been harrowed once or twice since planting. Rather large seed pieces should be planted 2 or 3 in. deep, and the hills should be placed 18 by 18 or 12 by 24 in.

Potato investigations, E. P. SANDSTEN and E. J. DELWICHE (*Wisconsin Sta. Rpt. 1906, pp. 227, 228*).—These investigations were carried on at the substation at Iron River, on land which had been in potatoes for several years, with the exception of ½ acre which was in clover. The land was divided into 4 plats, the first receiving 10 loads of well-decomposed barnyard manure per acre, and the second a dressing of 200 lbs. of nitrate of soda, 200 lbs. of potash, and 300 lbs. of desiccated bone, applied July 2 and 19. The third plat received no fertilizer, and on the fourth a heavy crop of green clover was turned under.

The first plat gave an increase of 13.7 per cent, the second of 10 per cent, and the fourth of 37.2 per cent over the check plat.

Tobacco investigations, E. P. SANDSTEN (*Wisconsin Sta. Rpt. 1906, pp. 201–208, fig. 1*).—Work has been carried on for 3 years in the lines of improving Wisconsin tobacco by breeding and selection, the use and value of commercial fertilizers and barnyard manure in growing the crop, the use of cover crops in this connection, and the proper handling and curing of the leaf.

A variety of Wisconsin-grown Connecticut Havana was selected as a type suited to Wisconsin conditions in the work of improvement by breeding and selection. The object in view was the production of a broader and larger leaf with a more rounded outline than the Connecticut Havana, but retaining the high quality and compactness of this variety. This work at present indicates excellent results.

The fertilizer work has led to the conclusion that the best application consists of 10 tons of barnyard manure, 100 lbs. of nitrate of soda, 150 lbs. of sulphate of potash, and 200 lbs. of desiccated bone per acre.

Very satisfactory results have been secured during 2 years with hairy vetch as a cover crop on tobacco fields. The seed was sown immediately after the tobacco was harvested, at the rate of 60 lbs. to the acre and cultivated in.

A description is given of the shed constructed at the station for the purpose of studying the conditions of curing.

Tobacco breeding, A. D. SHAMEL and W. W. COBEY (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 96, pp. 71, pls. 10, figs. 14*).—This bulletin treats of the variability in tobacco plants and the introduction and acclimatization of varieties, describes the structure and arrangement of the flowers, discusses the necessity for inbreeding, the improvement of the shape of the leaves, their modification in size, and the control of their number on individual plants, considers the production of nonsuckering types of tobacco and of early varieties, and points out the value and desirability of improving the burning quality. Rules are given for the selection of seed plants, and the method of keeping the records of breeding work made in the field, as well as the permanent record, is outlined. Methods of saving seed and a process of separating the seed with a tobacco seed separator are described. The possibility of selecting disease-resistant types is also discussed.

A description is given of a new variety of tobacco produced by seed selection. This new variety is known as Uncle Sam Sumatra and was produced by seed selection begun in a Connecticut shade-grown crop in 1903. The characteristics of the variety are extremely round leaves of fine texture, small fine veins at right angles from the midrib, and a large number of leaves with great uniformity of size and shape from the base to the top of the plants. The quantity of seed produced by the variety is very small, and very few and small suckers develop at any time during the growing season. The pedigree record of the original plants and their progeny shows the following averages: 21 leaves per plant, leaves $20\frac{1}{2}$ in. long and $14\frac{1}{2}$ in. wide, 3 small suckers, plants 6 ft. high, growing period 90 days, length of internode $3\frac{1}{2}$ in., and circumference of stem $3\frac{1}{2}$ in.

Descriptions are also given of the Cooley hybrid and the Brewer hybrid, new varieties produced by hybridization and seed selection, and described in former reports.

Eradication of wild mustard, R. A. MOORE and A. L. STONE (*Wisconsin Sta. Rpt. 1906, pp. 259–269, figs. 6*).—Spraying grain fields with a 20 per cent solution of iron sulphate destroyed practically all the wild mustard plants. It is recommended that the spraying be done on a calm, bright day after the dew has disappeared and at a time when the mustard plants are in the third

leaf, or before they are in blossom. Daisies, cocklebur, bindweed, ragweed, chicory, sheep sorrel, yellow dock, wild lettuce, and many other weeds were partially or wholly eradicated from the fields where these tests were made.

Three acres and liberty, B. HALL ET AL (*New York and London: The Macmillan Co., 1907, pp. 435, pls. 14*).—This book is written with the purpose "to awaken active and earnest thought upon the social betterment of our rapidly increasing population.". Among the different subjects discussed are buying a farm, results to be expected, methods of management, gardening, tools and equipment, beds and greenhouses, various uses of land, fruit, flowers, drug plants, novel live stock, and buildings.

HORTICULTURE.

The garden book of California, BELLE S. ANGIER (*San Francisco and New York: Paul Elder & Co., 1906, pp. VII + 141, pls. 20*).—This book contains suggestions for beautifying the home grounds by the use of trees, shrubs, vines, and flowers, of which a large number of varieties are recommended for different forms of planting. Chapters are devoted to simple garden methods, a planting calendar, and a discussion of insect pests and plant diseases and their general remedies.

Among the special subjects considered are the culture of common plants, bulbs, palms and tropical plants, roses and ferns, ferneries, hedges, tree planting and protection, back-yard problems, the making of pergolas, and the equipment of the aviary. In the closing chapter a list is given of some of the most valuable and showy native annuals, together with the varieties of native trees and shrubs recommended.

Report of the horticulturist, C. P. CLOSE (*Delaware Sta. Rpt. 1903, pp. 117–140*).—The following lines of work received especial attention during the season of 1903: The use of nitrate of soda on asparagus, root forcing on fruit trees, orchard cover crops, pruning Kieffer pear trees, commercial fertilizers in apple orchards, fruits in preserving fluids, dipping nursery trees in kerosene and crude petroleum, paint on fruit trees, and special pruning of fruit trees. Previous experiments with the use of nitrate of soda on asparagus have been noted (E. S. R., 15, p. 578).

The outline of the asparagus test was as follows: 200 lbs. of nitrate of soda was used per acre, applied in 4 equal applications 10 days apart, the first application being made 10 days before the cutting began. This experiment was conducted at the farms of 2 cooperators and the results are tabulated. The gain in yield for the fertilized plats over the unfertilized plats is not sufficient to signify any particular benefit from the nitrate of soda.

Previous work with root forcing on fruit trees has also been noted (E. S. R., 15, p. 578). In order to get more data from trees grown 1 year, 12 peach trees and 8 apple trees were planted in the spring of 1902. Of the 12 peach trees 4 had 2 strips of bark about ½ in. wide removed from the roots, 4 had 1 strip removed, and 4 were left as checks. Of the 8 apple trees, 3 had 2 strips of bark taken from the roots, 3 had 1 strip, and 2 were left as checks. The trees were dug the latter part of November and the records of top growth and the grade of the root systems are tabulated. The results obtained in this experiment for the 2 seasons point to the impossibility of forcing a large development of roots from the callus formed as the result of removing these strips of bark from the roots.

Tests were made with a large number of orchard cover crops, both at the experiment station and with cooperators elsewhere, and notes are given as to the behavior of each crop tested.

In the spring of 1903 a pruning experiment was started with Kieffer pears in the 2-year old orchard of F. M. Soper, at Magnolia, in which it was desired to compare the results of early severe with early moderate pruning, and these kinds with late moderate pruning after the trees were in full foliage. The trees had never previously been pruned. As to the results, all that could be determined in 1903 was the extent of growth and appearance of the foliage, which was considerably better on the trees pruned early and severely. Those pruned early and moderately were next best, being much better than the late pruned trees.

An outline is given of commercial fertilizer tests planned to be conducted in apple orchards, in which it was decided to use a fertilizer containing 200 lbs. of nitrate of soda, 85 lbs. of acid phosphate, and 165 lbs. of muriate of potash as the standard formula. Variations of this formula were also to be used in conjunction with cover crops.

In the hope of finding a preserving fluid capable of holding the color and shape of various fruits, the writer made several tests with a great variety of preservatives. Notes are given as to the behavior of apples, peaches, and plums in these different mixtures. In general, no satisfactory preservative was obtained.

A test was made in order to determine what injury would result by dipping nursery trees in a bath of kerosene or crude petroleum for the prevention of scale. A V-shaped trough 8 ft. long was the dipping receptacle, in which the tree was dipped and thoroughly covered with the insecticide. The trunk just above the roots was treated by pouring the insecticide over it. The trees treated included peach, pear, apple, and cherry, and the results are tabulated. The results show more or less severe injury in all cases, whereas in each case the check trees passed through the winter in good shape. The treated apples and pears appeared to suffer less from injury than the peaches and cherries. The use of crude petroleum is somewhat less dangerous than kerosene.

It is sometimes the practice to paint the trunks of trees to prevent injury by rabbits, mice, borers, etc. In order to determine whether this treatment has any injurious effects on the tree, several young apple, pear, and peach trees were painted in the fall of 1903. The paint used was pure white lead, thinned with raw linseed oil. The soil was removed down to the roots and the paint applied on the trunk from the roots to 18 in. above the ground. No injury whatever followed the use of this paint.

The work in regard to the special pruning of fruit trees was carried on as previously outlined (E. S. R., 15, p. 578).

Report of the horticulturist, H. C. HENRICKSEN (*Porto Rico Sta. Rpt. 1906, pp. 18–24, pls. 2*).—The horticultural work conducted at the Porto Rico Station consists mainly of tests as to the adaptability of economic fruits; the introducing and testing of new varieties; the selection of superior native varieties; methods of propagation, planting, and fertilization; experiments in shipping fruits to distant markets; and the distribution of seeds and plants of varieties which have given promising results. A summary is given of results secured with the following plants under investigation: Pineapples, mangoes, avocados, citrus fruits, cacao, and grapes. Several other fruits and plants are noted as to their general behavior.

Of the pineapples, the Ruby, a variety from Jamaica, appears to be the most promising of the less-known kinds tried. The Variegated Lajas, a variety found by the writer near Lajas, produced fruit during the past season. The variegation is in the fruit, as well as in the plant, making it valuable for decorative purposes, while the quality is said to be equal to that of the ordinary Cabezona. Attempts have been made for several years to ship the Cabezona pineapple

to the States. These generally proved unsuccessful, apparently because of rough handling, bad packing, and wet seasons. In 1906 the season was favorable for shipping, and experiments were continued. Of shipments made to New York, a very small percentage of the fruit was spoiled. Shipments to Boston and Washington were reported as having been received in perfect condition. A special crate has been made for the Cabezona, which measures 16 in. wide, 14 in. deep, and 30 in. long, holding 8 pines weighing from 6 to 12 lbs. each. In harvesting the Cabezona a portion of the stem must be cut off with the pine, since when the pine is removed from the stem, as is done with the Red Spanish, a cavity is left in the end of the fruit in which decay rapidly starts.

Experiments were made in dipping the fruit in solutions like ammoniacal copper carbonate and a weak formalin solution, as well as dipping the ends of the stems in melted paraffin, which, however, appeared to be of no benefit.

Over 100 varieties of citrus fruits are being tested at the station, and some very desirable local varieties have been found. An entirely seedless orange, found near Mayaguez, is said to be very promising, and a perfect navel, also entirely seedless, was found near Penuelas and budded at the station under the name of Penuelas Navel. Extensive fertilizer experiments with citrus fruits are being conducted in cooperation with planters.

Several varieties of cacao imported from Trinidad and planted in 1903 are now fruiting, but the fruit is seriously attacked by the pod disease. Investigations are to be made to determine if picking and burning the diseased pods and spraying can be done with profit.

Some Early Harvest and Red Astrachan apple trees planted in April, 1905, bore fruit during the past season of fair quality and not the least diseased. Peaches of the Peen-To, Jewel, and Waldo varieties, planted at the same time, have also produced fruit of first-class quality.

About 1,000 packages of seed and plants have been distributed to planters on the island and to various points in the United States and abroad.

Vegetable growing in Porto Rico, H. C. Henricksen (*Porto Rico Sta. Bul. 7, pp. 64, pls. 10, figs. 2*).—This is the Spanish edition of this bulletin, the English edition having been previously noted (E. S. R., 18, p. 142).

The use of manure as a summer mulch in vegetable forcing houses, W. J. Green and C. W. Waid (*Ohio Sta. Circ. 69, pp. 4*).—In this circular an account is given of an experiment conducted at the Ohio Station during the past 2 seasons on the use of strawy manure on the soil as a mulch during that part of the summer when crops are not growing in the greenhouses.

The crops tested were tomatoes and lettuce. The soil was mulched to a depth of 5 or 6 in. with fresh strawy manure, and water applied in the form of a spray until the manure and soil were thoroughly wet. Watering was repeated often enough to keep the soil moist. At planting time the coarse part of the manure was removed and the finer portion was worked into the soil; soil mulched in this manner was found to be in good mechanical condition and darker in color than unmulched soil. On the lettuce plats 3 successive crops were raised without the application of any additional manure or fertilizer. Liquid manure was furnished the tomato plants when the fruit began to ripen. This method of treating the soil gave very favorable results at the station.

Similar experiments were also conducted by the Miller Bros. of Toledo, Ohio, in the past 2 seasons unknown to the station authorities. As a result of the two series of experiments the station recommends this mulching for soils which are to be used for vegetable forcing. The manure should be sufficient in quantity and richness to furnish enough plant food when leached into the soil to supply 3 crops of lettuce, and should be applied to a depth of at least 5 or 6 in. A considerable quantity of coarse material in the manure is said to be an advan-

tage. Where it is the practice to mulch the cucumber or tomato crop, the manure used for that purpose can be left on and more added in cases where the cucumbers or tomatoes have been free from disease. Otherwise the mulch should be removed and new applied. Frequent sprinkling of the manure on the beds is considered very essential in order to cause the richness to leach into the soil.

In a discussion of the bad practice of allowing the soils to dry out during the summer, the authors quote from Stone and Smith (E. S. R., 14, p. 157), to the effect that in drying out of the soil the activity of the Sclerotinia or Drop fungus is apt to be accelerated, which largely increases the amount of infection in the succeeding crop of lettuce. The other injurious effects in drying out the soil are manifested in a stunted growth, and abnormally colored and worthless crops.

In the mulching experiments conducted by the Ohio Station and Miller Bros., although no attempt was made to study the effect of mulching on diseases affecting lettuce, the crops are reported as having been practically exempt from these diseases.

Greenhouse experiments for 1906, J. G. Moore (*Wisconsin Sta. Rpt. 1906, pp. 221–226*).—A preliminary report of experiments conducted at the greenhouse in 1906. In addition to experiments to determine the influence of excessive feeding of plants, a variety test with radishes and 3 experiments with tomatoes, lettuce, and cucumbers were conducted in the greenhouses during the past year.

The experiment with tomatoes was to determine the relative earliness of fruiting and the amount of fruit produced by plants grown from cuttings and those grown from seed. The results thus far indicate that it is very hard to choose between cuttings and seedlings for use in the forcing-house.

Experiments were conducted with lettuce to determine the advantages of the relative value of subirrigation as compared with surface watering. The experiment is discussed at length. Two crops of lettuce were grown. The first crop was harvested from January 15 to 31 and the second crop from April 2 to April 7. In summing up the results from both crops it was found that the surface-watered bench yielded nearly 60 lbs. more lettuce than did the subirrigated bench, or a difference of approximately 600 lbs. for a house 20 by 100 ft. Judging from these results the author is of the opinion that with proper care as large crops can be produced with surface watering as with subirrigation, and that the added precaution necessary in surface watering is more than offset by the difficulties and cost connected with the subirrigation system. The relative effect of these 2 methods of watering on the control of rot has not yet been sufficiently studied to warrant a statement.

An experiment is being conducted to determine the value of super-heated soil or bottom heat in the forcing of cucumbers.

A test of varieties of tomatoes, and further notes and experiments with western blight or yellows, L. F. Henderson (*Idaho Sta. Rpt. 1906, pp. 14–28*).—A variety test with tomatoes commenced by L. B. Judson was completed by the author. A chart is given showing the varieties used, with notes in each case as to whether the vines were pinched or unpinched, and the fertilizer used, if any. The test included 53 rows with 95 plants to the row. Data are also given showing the number and weight of sound and the number of rotten tomatoes gathered from each row at the time of the first picking, and the average for the 3 pickings.

The results of fertilizer experiments are tabulated, and the following deductions are drawn: Plants treated either with nitrate of soda or in most cases with sulphate of iron gained nothing the first year in earliness over

those untreated, whether pinched or unpinched, nor in total production of fruit for the 3 pickings. The number of rotten tomatoes was greater where sulphate of iron was used. In every case the unpinched plants gained in earliness over those pinched. The apparent lack of results from the use of fertilizers is believed to be due to the fact that the ground was already rich enough in natural food elements.

In general, the results of the experiment are summarized as follows: Fertilizing good ground in Idaho seems unnecessary. Pinched plants grew fewer tomatoes than the unpinched plants. Sparks Earliana outran all others in earliness and amount of yield for 3 pickings, followed by Nolte Earliest, Maule Earliest, and Mikado. Lists are given of tomatoes desirable as to their solidity, smoothness combined with solidity, and resistance to frost.

The experiments for western blight as noted (E. S. R., 17, p. 1076) were continued, particular attention being paid to water, manures, and shading from sun and wind. The results are given, together with the notes of other tomato growers in regard to blight. On the evidence secured, the author is of the opinion that good plants set in good soil, well watered, and above all protected from the hot sun and heavy winds, will not blight very much.

Celery, W. R. BEATTIE (*U. S. Dept. Agr., Farmers' Bul. 282, pp. 36, figs. 16*).—This is a revision and extension of Farmers' Bulletin 148 (E. S. R., 13, p. 1045), and is intended to take the place of that bulletin.

Popular directions are given for the culture of celery, in which the various phases of the industry are considered, including a discussion of the climate, soils, fertilizers, sowing, planting, cultural methods, diseases, insect enemies and their control, methods of blanching, storing, marketing, and estimates as to the cost of production and returns. The text is accompanied by many illustrations, and the bulletin concludes with lists of varieties recommended for planting for home use and for market.

The best way to grow celery, W. H. JENKINS (*Farming, 3 (1907), No. 4, pp. 136, 137, figs. 6*).—Popular directions are given for the intensive cultivation of celery, in which all phases of the subject are considered, including varieties recommended for planting and culture under irrigation methods. A homemade celery planter is described and illustrated, which is said to mark the rows, make holes for the plants, and supply water for 2 rows at a time as fast as a man walks. The cost of growing celery according to the intensive plan is estimated as $460 per acre, and the gross receipts as $1,000 per acre, making a profit of $540 per acre.

Cranberry investigations, A. R. WHITSON, O. G. MALDE, and C. B. HARDENBERG (*Wisconsin Sta. Rpt. 1906, pp. 135–159, figs. 3*).—The present investigations have corroborated many results obtained from previous work (E. S. R., 18, p. 239). Further information is given on the influence of drainage, sanding, and weeding on soil temperatures, on cultural methods and insect enemies, and on methods of preventing injury by worms. A collection of all the small moths found on cranberry marshes has been started in order to enable the grower to distinguish between the injurious and noninjurious species. A list is given of the moths which have been identified, together with notes on the injury done by various worms.

Observations of soil temperatures at 3 and 6 in. below the surface and of air temperatures at 2 in., 3 ft., and 40 ft. above the surface were made at 7 o'clock both morning and evening during the months of August and September and are here tabulated. Attention is called to the great difference in minimum temperature on nights when the temperature gets low on account of excessive radiation, between plats which are relatively free from weeds and have a surface sanding

and those which are weedy and poorly drained, it being much lower in the latter case.

The importance of keeping cranberry grounds as free as possible from weeds and pruning the vines is again brought to the attention of the growers as one method of lessening the danger from frost. The minimum temperatures taken from May 9 to Sept. 30 in the vines 2 in. above the surface of the ground and in the air 3 ft. above the ground are tabulated. From this data it is shown that the low temperatures and formation of frost locally are largely the results of radiation, and that under conditions favorable for this process the temperatures in the vines go much below that of the air a short distance above.

A 3 years' summary is given of 3 plats which were drained to a depth of 14 in., of 4 to 8 in., and with water at the surface, respectively. The average yield for the 3 years is slightly in favor of the plat drained to a depth of 14 in., and the results appear to be in favor of thorough drainage, the benefits derived being attributed to the warmer average temperature of the drained soil.

The observations of 1905 on the relation of the humidity of the atmosphere at 7 p. m. to the minimum temperature of the night have been repeated during 1906, from May 19 to September 30, and are presented in tabular form, in which it is shown that the temperature of the night frequently went 20° below the dew point of the evening, and in one case 26.2° below the dew point at 7 p. m. The fall of the temperature below the dew point on clear nights was accompanied by excessive dew.

Sanding the plats appeared to increase the yield and also made an increase in uprights by covering a multitude of runners and allowing them to root, thus invigorating the whole plant. In the fertilizer tests the application of nitrate and phosphate gave the best results, as in previous experiments.

An experiment was conducted to determine whether the removal of moss and other forms of vegetation from vines before planting lessens the growth, either by injuring the vine or by removing matter which would otherwise act as a mulch. Thus far the results seem to be in favor of cleaning the vine.

In an experiment carried on to determine the advantage of covering a portion of the vines with muck as they are planted in comparison with planting in the usual way by tamping, no difference was noted in favor of covering with muck. On the other hand, much additional weed seed was added to the plats by the muck.

With reference to the value of planting cut and uncut vines, the growth was found to be practically the same in both cases. Comparisons were made of propagation by cuttings and from seed, the former being the usual method. The results of these comparisons are given in a table and show a great uniformity of parent and seedling in respect to color, size, and shape.

With respect to the effect of flooding on the fruit, the conclusion has been deduced that while cranberries will stand a long flooding where the water is of a low temperature, the use of water above 65° must be of shorter duration.

In a comparison of spraying, flooding, and the use of kerosene for preventing injury by worms, spraying with arsenates has been found an effective means of keeping the insects in check, both as a preventive and as a remedy. Spraying should commence not later than July 1 to obtain the best results and be followed by 1 or 2 further applications at intervals of from 10 to 14 days. Flooding as a remedy for fruit-worm is not to be relied upon under the temperature conditions prevailing on the open marshes of Wisconsin during the period when it would be most effective, unless water of a sufficiently low temperature can be obtained, in which case it is stated that there is no remedy that is more effective and more easily applied than a submersion of the vines, which should continue at least 2 nights and 1 day. A short flooding, sufficient to bring the worm out

of its retreat, followed by the application of a contact poison as soon as the water is removed, is said to be a treatment well suited to Wisconsin conditions. Experiments with kerosene for this purpose and the use of torches have not proven satisfactory thus far.

The importance of clean culture is strongly emphasized for the destruction of favorable hibernating places for insect pests. Both fruit-worms and black-headed vine worms were found to be attacked by a special parasite, the species of which has not yet been determined. The percentage of the affected individuals is not large and the parasite can not be relied upon to keep the worms in check.

The possibilities for fruit growing in Lake Superior region, E. P. SANDSTEN and E. J. DELWICHE (*Wisconsin Sta. Rpt. 1906, p. 230*).—Investigations have been made to study the possibilities for fruit growing on Bayfield Peninsula and at other points in the Lake Superior region. It is believed that Bayfield Peninsula, through its favorable location, will in the near future produce apples and cherries sufficient to supply the immediate wants of nearby markets. To encourage fruit growing in this region, and to study the adaptability of the various varieties, trial orchards have been established at several points.

Orchard fruits, E. P. SANDSTEN (*Wisconsin Sta. Rpt. 1906, pp. 219, 220*).—An outline is given of the fruit investigations at the station.

In the work of improving the native plum, started about 12 years ago by the late E. S. Goff, out of a total of 50,000 seedlings grown from standard varieties some 5 or 6 superior varieties have been selected and are now being propagated. The author states that as a result of the work it is shown that the native plum comes true, or nearly true, from seed in spite of the fact that the parent trees, from which seed has been gathered have grown close together and have been freely exposed to cross-pollination. It is the author's opinion that any difference between the seedlings and the parent trees can be accounted for largely by the difference of soil and cultural methods. The experiments seem to indicate that high culture and persistent selection will accomplish more for the native plum than direct crossing between the existing native varieties. During the past 3 years a number of attempts have been made to cross the native plum and the Japan and European varieties, the results being unsatisfactory since in every instance where crosses were secured the seed failed to grow.

Most of the seedlings in the experimental work in the apple orchard fruited during the year and several very promising varieties were grown.

In order to give general advice in regard to small fruits, most of the leading varieties of gooseberries, currants, and strawberries have been planted, of which records will be kept and data obtained for future reference.

Ampelography, G. MOLON (*Ampelografia. Milan: Ulrico Hoepli, 1906, vols. 1, pp. XLIV + 640, figs. 45; 2, pp. 641–1243, figs. 80*).—A compilation of scientific knowledge on the grape, with descriptions of the better varieties of grapes and practical notes with respect to their cultivation for wine and table use, and their value as graft-stocks and direct bearers.

The work is divided into 7 parts. In part 1 is assembled the available botanical knowledge with reference to the Ampelideæ (Vitaceæ). Succeeding portions of the book are devoted to the various ampelographic classifications, bibliography, and descriptions, together with a large number of practical notes on varieties of grapes. The work closes with a list of synonyms and tables showing the varieties best adapted to different purposes.

Report of the coffee expert, J. W. VAN LEENHOFF (*Porto Rico Sta. Rpt. 1906, pp. 29–31, pl. 1*).—An improved condition in regard to production is reported among the coffee growers of the island, although little progress has been attained in influencing the American taste to a liking for Porto Rican coffee.

The work on the experimental tracts has been confined chiefly to the care of the plantings made in accordance with experiments outlined in previous reports (E. S. R., 16, p. 144; 17, p. 351). In addition, grafting has commenced in the new coffee plantings, together with fertilizer experiments in both the old and new plantings. A great number of the best varieties of coffee in various countries have been brought together for the purpose of selecting for planting those which bring the highest prices in the markets of the world. Inferior varieties are to be discarded and an attempt will be made to distribute the promising varieties as rapidly as possible among the planters.

In the hope of obtaining a better yield, the station is conducting a series of experiments in fertilizing coffee trees. Coffee is said to bloom in Porto Rico at different periods, according to the altitude and locality. The blooming period on the experiment station tract ranges from February to May, consisting of 1 principal blossoming followed by 1 or more smaller blossomings. The berries ripen about 7 months after the blooming period. Harvesting begins in September and lasts until January, during which time about 10 pickings are made at intervals.

With a view of determining how long wet coffee can be kept without damage to quality and also to determine if the sprouting process influences the flavor, the following experiment was made: On December 30, 1905, a quantity of fermented and recently washed coffee in the parchment skin was put in a heap on a cement floor in a basement resembling a malt cellar. The heap was turned daily. During the sprouting process and before turning, the upper layer, having become dry, was sprayed with water of ordinary temperature. As soon as sprouts of the length of the berry had developed these grains were taken out and dried. By January 23, 1906, the first grains began to sprout, and a month later all the grains had sprouted. The bulk of the coffee was then dried in the ordinary way and hulled. This coffee was submitted to different consumers, roasters, and dealers in the United States, and was generally pronounced to be of good quality and flavor. By some the flavor was claimed to have been improved by the sprouting process.

FORESTRY.

The Forest Service of the United States, O. W. PRICE (*Canad. Forestry Jour., 3 (1907), No. 1, pp. 14–18, pl. 1*).—An outline of the essential progress made by the United States Forest Service along the main lines of forest work.

Report of forest nurseryman, D. HAUGHS (*Rpt. Bd. Comrs. Agr. and Forestry Hawaii, 3 (1906), pp. 67–83*).—A report of the work at the government nursery, the Nuuanu station, and the Tantalus forest for the year ending December 31, 1906.

Statements are given of seeds and plants collected, propagated, and distributed, of plantations visited—showing the nature of the advice and assistance given to those outside of the district of Honolulu—the experimental work, and the number of fires during the year.

The experimental work at the nursery has been along the lines of seed testing and the propagation of new and rare plants, in which various forms of rubber trees have been given considerable attention.

State nursery for forest tree seedlings, L. R. JONES (*Vermont Sta. Bul. 127, pp. 43–52*).—The Vermont general assembly of 1906 passed an act to aid in the establishment and maintenance of a nursery for forest seedlings at the Vermont Station. The various sections included under this act are given in the bulletin.

Under section 3, the law requires that the experiment station shall, as soon

as possible, furnish to all applicants who are residents or landowners of Vermont, material for forest planting as near actual cost as possible. The station here offers an assortment of 4 different classes of white-pine seedlings for forest and nursery growing, together with a few black locust trees, and gives advice to prospective buyers in regard to which class of trees to buy, together with notes relative to forestry planting, the kind of trees to plant in Vermont, the time and method of planting, transplanting native seedlings, seed collecting and sowing, and making nursery beds. A detailed discussion of forest planting in Vermont has been previously noted (E. S. R., 17, p. 1074).

Report of district foresters (*Rpt. Bd. Comrs. Agr. and Forestry Hawaii, 3 (1906), pp. 84–118*).—This report consists of brief statements of several of the district foresters of the Territory of Hawaii as to the present extent and condition of the native forests, the extent of private forest reserves, the area of forest land exempt from taxation, and the forest plantings for the year, together with general notes on forestry.

Forest management in southern pines, M. ROTHKUGEL (*Forestry Quart., 5 (1907), No. 1, pp. 1–10*).—The author was employed for some time as forester for a large lumber company near Charleston, S. C., and gives a description of the system of fire protection adopted by that company, together with notes on the management of loblolly and longleaf pine areas for the purpose of obtaining a constant supply of lumber.

Report of the controller, experiment station, Peradeniya, H. WRIGHT (*Circs. and Agr. Jour. Roy. Bot. Gard. Ceylon, 3 (1906), No. 24, pp. 301–339*).—This is a tabulated report of experiments commenced or continued at the station during 1905 with cacao, rubber, tea, citronella grass, lemon grass, and groundnuts. An enumeration is also given of 146 one-acre plats, showing the present plantings of cacao, coffee, cinnamon, annatto, croton, areca nut, cocoanut, pomelo, teak, different species of rubber, and several other varieties of important trees. Since the first report of 1903 (E. S. R., 16, p. 265) the plantings of various trees have increased from 38,231 to 83,163 in 1905.

The work with cacao consisted in the excision of cankers and experiments in spraying and fertilizing, and the results, together with notes on the progress and composition of the crop, flower periodicity, and returns from plots, are presented in tabular form. Results are given of yields secured from some of the rubber trees, showing the date of each tapping, the amount of rubber obtained, and the total amount of rubber obtained for the season. Four Peradeniya trees, 29 years old, produced from V-shaped cuts a total of 11 lbs. 5¾ oz., and 4 similar trees yielded from long spiral cuts a total of 17 lbs. 8¾ oz. for the season.

Treatment of cooperative forestry plats (*Ohio Sta. Circ. 68, pp. 4, fig. 1*).—This circular contains advice on the pruning of forest trees at planting and in the nursery. The locust, catalpa, mulberry, and osage orange are discussed somewhat in detail.

Experience thus far has shown that if, before planting, the tops are cut off 1 or 2 in. above the point where the top and root join, the result is better than if the cut is made several inches higher, since but one sprout usually starts where the cut is made low down, and a clean, vigorous growth is assured. This treatment is advised for all young forest trees except evergreens. The practice of allowing catalpa trees to grow 2 or 3 years before pruning is not to be recommended, since although a long stem is usually secured it is apt to become top-heavy and easily damaged by the wind when the foliage is wet. The better plan is to keep the trees growing straight from the start. In cases of crooked trees, or where severe injury has been caused by mice or rabbits, the trees should be cut to the ground regardless of their age.

It has been found that trees grow much faster under cultivation than when in

sod. The cultivation of locust trees for more than one season is of doubtful utility, since if the roots are lacerated sprouts will spring up. Banking the trees with a few shovelfuls of earth each fall lessons the risk of the trees being gnawed by mice.

The importance of climatic varieties of species of trees for sylviculture, A. CIESLAR (*Centbl. Gesam. Forstw., 33 (1907), Nos. 1, pp. 1–19; 2, pp. 49–62, figs. 8*).—An account is given of investigations made by the author and others on the adaptability of species of trees grown in high altitudes for planting in lowland countries, and vice versa. The principal trees discussed are the spruce, larch, white and black pine, and sycamore.

As a result of these investigations the author concludes that in the reafforestation of any area trees should be used which are native to that particular climate.

Table for determining the financial increment per cent of trees based on their market values, N. B. ECKBO (*Forestry Quart., 5 (1907), No. 1, pp. 37–39*).—This table, prepared by E. Overland, forest estimator in the Norwegian government service, is explained in detail and is said to be of the same value in uneven-aged stands as in even-aged, since the rate of increase of each diameter class is determined separately.

New method of measuring volumes of conifers, B. E. FERNOW (*Forestry Quart., 5 (1907), No. 1, pp. 29–36*).—The author states that the most important development in mensuration in later years is the substitution of the "form quotient"—as elaborated (after Schuberg's proposition) by Schiffel—for the "form factor." As a result of further investigations made at the Austrian experiment station, Schiffel reports that "all conifers (the European fir, spruce, pine, larch) can be approximately but sufficiently accurately cubed upon the basis of one and the same form quotient table."

The author gives a brief explanation of Schiffel's method, together with formulas and tables used.

The influence of light and of changing temperatures on the germination of seeds of cultivated plants, especially pine, A. ATTERBERG (*K. Landtbr. Akad. Handl. och Tidskr., 45 (1906), No. 3–4, pp. 299–315*).—A review of the literature on this subject is given, together with a report on experiments along this line. It was noted that variation in temperature does not equal the beneficial effect of light in the germination of pine and many other kinds of seed.

The best methods of germinating the seeds of different agricultural crops are discussed.—F. W. WOLL.

Observations on the effects of spring and autumn frosts in 1905–1906, H. J. ELWES (*Quart. Jour. Forestry, 1 (1907), No. 2, pp. 169–179*).—Notes are given as to the effect of frost on a large number of hardwoods, conifers, and shrubs during the spring and autumn periods of 1905 and 1906.

India rubber on the island of Cuba, H. C. PEARSON (*India Rubber World, 36 (1907), No. 2, pp. 237–242, figs. 14*).—An illustrated account of a large number of species of both exotic and native rubber-producing plants found in Cuba, with suggestions as to the value of the different species.

Present and future phases of the India rubber industry, TOBLER (*Sitzber. Naturhist. Ver. Preuss. Rheinlande u. Westfalens, 1906, I, pt. C, pp. 7–9*).—This is a brief report of a lecture delivered by the author on the various phases of the rubber industry, in which mention is made of the synthetic production of caoutchouc by Harries from the residue obtained in the manufacture of sugar. Reference is also made to the various families of rubber-producing plants.

The cocoanut palm in Ceylon, J. FERGUSON (*Jour. Ceylon Branch Roy. Asiatic Soc., 19 (1906), No. 57, pp. 39–70, map 1*).—This is a paper on the beginning, rise, and progress of cocoanut cultivation in Ceylon from earliest times to 1660, the close of the Portuguese occupation of the maritime provinces,

in which the author refers to a great number of early writers on the subject. At the beginning of the last century it was estimated that there were 10,000,000 cocoanut palms in Ceylon. The author intends to cover the Dutch and British periods in a later paper.

A map is given showing the location of the early cocoanut plantations in Ceylon.

The Tavistock woods, W. SCHLICH (*Quart. Jour. Forestry, 1 (1907), No. 2, pp. 156–164*).—This is an account of sylvicultural work which has been conducted in the Tavistock woods, the property of the Duke of Bedford, during the last 8 or 9 years. A general description of the forest growth, the plans for the management of the woods as laid down by the author in 1898, and a summary of the work actually carried out are given. The plans include the treatment of oak timber areas, mixed woods, simple coppice woods, and standels.

During the past 8 years over 620 acres have been stocked with various species of hardwoods and conifers.

Evergreens for the Iowa planter, A. T. ERWIN and H. P. BAKER (*Iowa Sta. Bul. 90, pp. 46, figs. 16*).—Early in the seventies the horticultural section of the Iowa experiment station instituted an extensive experiment in the testing of new species of evergreens to determine their hardiness and value for Iowa conditions. This work has been continued from year to year and this bulletin is the first report of these investigations.

A record is given of the behavior of the more important species of evergreens tested both at the station and throughout the State generally, together with estimates of their value for the Iowa planter. Part 1 is devoted to a general discussion of tree growing in Iowa, and the transplanting, cultivation, and pruning of evergreens. Part 2 consists of a report on species planted in the State with regard to hardiness, adaptability to various soils, comparative rate of growth, and general value for forestry and ornamental purposes. The groups considered are pines, larches, spruces, hemlocks, firs, cypresses, arbor vitaes, junipers, and ginkgos. A list is given of evergreens recommended for planting in different parts of the State under the conditions discussed, and many of the species are illustrated.

Preservation of wood used for telegraph poles, R. NOWOTNY (*Baumaterialienkunde, 12 (1907), No. 5–6, pp. 65–69*).—This is a comparative review of the various methods and materials either used or under experiment for the preservation of telegraph poles both in Europe and the United States.

DISEASES OF PLANTS.

Report of the botanist, H. L. BOLLEY (*North Dakota Sta. Rpt. 1906, pt. 1, pp. 28–36*).—The principal investigations carried on by the botanist have been in the study of resistance to disease in plants. An attempt was made to determine whether resistance to disease is an individual characteristic or whether this resistance is gained by gradual accretions from season to season. Especial attention was given to the possibilities of breeding resistant races of potatoes, flax, and wheat.

In the flax selection experiments the author has found that all cultivated varieties seem subject to wilt disease, but that they are not equally subject to flax rust. In his experiments with the flax rust, and cooperative experiments conducted at the Indiana Station he found that the flax rust passes all its different spore stages upon the cultivated flax. This explains the loss from rust in experimental plats which had been devoted to flax growing for a considerable number of years. The author recommends for farm practice that to

prevent excessive rust infection all rusty flax straw be thoroughly composted or burned and that rotation of crops be followed.

In his work with wheat, 401 different strains were under investigation, and all the plats were given every possible chance to become infested with the common wheat diseases.

An experiment was carried on to determine the effect of soil sterilization, in which the soil to a depth of 14 in. was sterilized and afterwards returned to the plat and seeded to wheat. The yield of straw and grain on the sterilized plat was above the normal growth of any near-by field crop, and the yield the second year after sterilization was more than one-third greater than a similar non-sterilized plat.

A brief account is given of experiments on the fertilization of clover and alfalfa, in which areas of red and white clover and alfalfa were covered with small meshed wire screen to exclude the larger insects. The results showed that alfalfa could partly fill under such conditions, while white clover produced about one-third as much seed under the screen as in the open, and only 1 head of red clover produced any seed.

In continuation of previous experiments, the author reports on tree feeding, stating that his experiments have progressed sufficiently far to permit a statement that formaldehyde, copper sulphate, and iron sulphate, when properly applied, tend to hasten the recovery of apple trees from sun-scald and sour heart, to check the development of apple blight, and may hold the plum-pocket disease in check. The method of applying the solution is fully described in a previous report (E. S. R., 16, p. 131). Brief notes are given on a plant survey of the State, fungus diseases, weed and seed laws, etc.

The wintering of grain rusts, A. H. CHRISTMAN (*Trans. Wis. Acad. Sci., Arts, and Letters, 15 (1904), pt. 1, pp. 98–107*).—The author gives a review of observations made by different investigators on the wintering of cereal rusts. In order to test the ability of rusts to winter as mycelium and uredospores in a latitude farther north than reported by others, he undertook a series of observations on several of the common rusts through the winter of 1902–3.

Well rusted plants could easily be found late in November, and during the winter and early spring material was gathered from rye, wheat, blue grass, and oats, some of the plats being protected by a covering of snow, while others were exposed during a greater part of the winter. Water cultures were made of the uredospores, and the germination of the spores as well as the maximum and minimum temperature of each day are shown in tabular form. Spores were germinated on every day noted except in one instance, where they were collected on February 18. It appears from the table that in the latitude of Wisconsin, and with a period of 3 months during which the temperature scarcely rises above the freezing point, viable uredospores may be obtained at practically any time during the winter.

It was noted early in the winter that in the case of badly rusted grain many of the leaves exhibited pale spotted areas, and sections of these showed the presence of mycelium and undeveloped spores.

Continuing his observations, the author found that in the spring of the year there were 2 distinct outbreaks of rust, the first occurring on the old winter leaves within 2 weeks following the first warm weather, while the second crop of uredospores did not appear until after the development of the first spring leaves. He found by experiment that in the cool weather of the spring the incubation period following inoculation is usually lengthened to between 3 and 4 weeks. The winter leaves die early in the spring and with them the winter mycelium, but not until it has produced uredospores which inoculate the new leaves. Between the dying of the old leaves and the appearance of rust on the

new a period of incubation takes place, which may be lengthened more or less according to the temperature and other conditions in the spring.

In conclusion the author says that as the severity of the winter must affect the amount of healthy host tissue that survives the winter, it must also limit the amount of mycelium and the number of uredospores in the spring, and that this in all probability is one of the chief factors in determining the violence of early outbreaks of rust.

Treating seed grains for the prevention of smut, R. A. MOORE and A. L. STONE (*Wisconsin Sta. Rpt. 1906, pp. 270–274, fig. 1, dgm. 1*).—Experiments were carried on by the authors to lessen the loss caused by smut diseases of barley. The treatments included soaking the seed grain in formaldehyde and corrosive sublimate solutions, and a modified form of the hot-water treatment.

The formaldehyde and corrosive sublimate treatments were effective in controlling the form of smut known as closed smut, but they were without effect for the loose smut of barley. For this the authors recommend soaking the seed grain for 12 hours in cold water, after which it is submerged for from 5 to 20 minutes in water at a temperature of 130° F. As this treatment is efficient for both forms of smut, it is recommended for combating smut diseases of barley.

A contribution to the biology of ergots, R. STÄGER (*Centbl. Bakt.* [*etc.*], *2. Abt., 17 (1907), No. 22–24, pp. 773–784*).—Inoculation experiments were carried on for 2 years with conidia and sclerotia of Claviceps on *Sesleria cærulea* from different localities to determine the possibility of biological races of this species. A considerable number of species of grasses were inoculated, but on only a few were the inoculations successful. The results obtained show the apparent identity of the ergot from 2 localities, the differences attributed being due to climatic conditions. Based upon his experiments the author gives an amended description of the biological race occurring on *S. cærulea*.

Infection experiments with Erysiphe graminis, G. M. REED (*Trans. Wis. Acad. Sci., Arts, and Letters, 15 (1904), pt. 1, pp. 135–162*).—The author conducted a series of inoculation experiments, using the conidia of *E. graminis* from blue grass and rye, and as host plants rye, wheat, oats, barley, squirrel tail barley, smooth brome grass, various species of Poa, rye grass, tall meadow fescue, orchard grass, timothy, floating manna grass, etc.

In the experiments with conidia from blue grass it was found that the mildew on *Poa pratensis* will not readily infect the other species of Poa experimented with. Under certain conditions it seems to be able to pass over to some extent to *P. nemoralis* and in a still less degree to *P. trivialis* and *P. compressa*. In the experiments with conidia from rye no inoculations were successful except on the control rye plants. In all the experiments the seedlings of rye which were inoculated with conidia from rye uniformly became infected, and this was also true when blue grass was inoculated with conidia from blue grass. When inoculations were made on other host plants in nearly every instance there was no infection.

The experiments confirm the general conclusion that spores of the mildew from one grass will not infect a grass belonging to a different genus. It seems probable that for *E. graminis* at least there is one if not more distinct species for each genus of grasses, and in some instances there may be a number of physiological forms upon the various species of the same genus.

Further researches on brusone of rice in 1905, U. BRIZI (*Ann. Ist. Agr.* [*Milan*], *6 (1901–1905), pp. 61–103, figs. 6*).—The experiments previously carried on by the author had indicated that brusone may be caused by physiological conditions. In the experiments upon which the present article is based, this problem was tested on a larger scale with 3 varieties of rice, which showed considerable differences in their resisting power toward unfavorable conditions

about the roots. When the usual supply of oxygen was withheld from the roots, yellowish, reddish, or brownish spots appeared on the leaves and other aerial portions of the stem within a few days. It was also observed that *Piricularia oryzæ* developed and fructified in some of these spots.

In control plants, however, kept under proper conditions for growth, it was found impossible to produce an infection with this fungus in a single case. These experiments are held to confirm results previously obtained and indicate that brusone is due to a deficiency or absence of free oxygen in the vicinity of the delicate absorbing rootlets. According to the author, practical rice growers have found that there is more danger of brusone when the rice is dry in the morning than when it is moistened with dew. These facts would be difficult to explain if the disease were due to a fungus.

While the author does not claim to have demonstrated beyond question the cause of brusone, he believes that it is probably due to the irregular or incomplete respiration of the minute absorbing rootlets still without a cork layer.

The winter rot of potatoes (*Jour. Bd. Agr.* [*London*], *13* (*1907*), *No. 12*, *pp. 739, 740, fig. 1*).—A description is given of a rot of potatoes in cellars and storage pits which is due to the fungus *Nectria solani.* For the prevention of this rot the writer suggests that potatoes should be well dried before storing and sprinkled with powdered sulphur during the process of drying. Land that has produced a diseased crop will certainly be infected with the fungus and should not be planted to potatoes again for several years. The use of lime or kainit is recommended on infected land.

Potato spraying experiment, E. P. SANDSTEN and J. G. MILWARD (*Wisconsin Sta. Rpt. 1906, pp. 209–218, figs. 3*).—In order to determine the actual cost under ordinary farm conditions spraying experiments have been carried on for the past 3 years in the principal potato-growing counties of the State. A detailed account of these experiments is given in a previous publication of the station (E. S. R., 18, p. 53). In 1905 experiments were conducted on 3 areas of 30 acres each in which 5 applications of Bordeaux mixture were sprayed at a cost of \$3.70 per acre, the net gain ranging from \$15.50 to \$36 per acre. In 1906 another series of experiments was carried on in which the average gains on 4 fields are expressed in yield per acre, the increases with 6 applications being 18.9, 40, 47, and 29 bu. per acre, respectively.

Pineapple and banana diseases, W. V. TOWER (*Porto Rico Sta. Rpt. 1906, p. 27*).—The author reports a serious trouble of pineapples following the planting of the crowns of the fruit. The plants rotted soon after being set, the first indication of disease appearing in the rotting of the lower leaves and underground parts, and later extending to the center leaves. The exact nature of the trouble has not been determined, but it was found that drying the crowns for 8 or 10 days before planting materially reduced the losses.

The disease of bananas briefly described is believed to be of bacterial origin and is characterized by the darkened areas found throughout the pseudotrunks of the plants. The affected portions of the plants have a very disagreeable odor. From the author's observations it is believed that much damage may result from this disease. A similar disease is said to have been reported in the Leeward Islands.

A disease of coffee, J. W. VAN LEENHOFF (*Porto Rico Sta. Rpt. 1906, p. 32*).—The author briefly describes a fungus disease which attacks coffee berries, the fungus apparently passing through the parchment and causing warty excrescences to appear on the grain. The disease was found to occur on trees grown in shade as well as on those without shade, but perfectly healthy trees were not observed to be affected. An examination of fresh berries indicated that the cause was probably *Stilbum flavidum.* Trees sprayed 3 times with Bordeaux

mixture at intervals of 2 weeks after the falling of the blossoms showed no disease during the succeeding season.

A bacterial disease of fruit trees, R. ADERHOLD (*Deut. Obstbau Ztg., 1907, No. 6, pp. 90–94, figs. 2*).—An account is given of a bacterial disease of cherry trees due to *Bacillus spongiosus*, which has been previously described (E. S. R., 17, p. 1165; 18, p. 947).

The distribution of the gooseberry mildew in Europe, W. HERTER (*Centbl. Bakt. [etc.], 2. Abt., 17 (1907), No. 22–24, pp. 764–773, figs. 3*).—The author traces the distribution of the gooseberry mildew (*Sphærotheca mors-uvæ*) in Europe for the year 1906, giving the reported stations where it has been observed in Ireland, Russia, Sweden, Denmark, Germany, Finland, Norway, and Austria-Hungary.

A new disease of cacao (*Agr. News [Barbados], 6 (1907), No. 128, p. 93*).—The writer states that diseased roots and stems of cacao were received from the botanic gardens at Trinidad in October, 1906, which upon examination were found to be infested with dark mycelial threads in the vessels of the roots and with hyphæ of other fungi in the medullary rays and other cells of the stem. The mycelium in the stem appeared to be continuous with black fruiting bodies, which are recognized as species of Lasiodiplodia.

Specimens of the stems submitted to this Department were said to be infested with the same fungus as that previously noted (E. S. R., 18, p. 452) as occurring on cacao and mangoes. The identity of the fungus in the roots has not yet been determined.

Attention is called to the presence of this fungus on cacao and other plants in widely distant regions in the West Indies. When the disease is found, all infested twigs and branches should be cut out and burned and dead trees should be uprooted and destroyed.

Diseases of cocoanut palms, F. A. STOCKDALE (*Agr. News [Barbados], 6 (1907), No. 127, p. 75*).—Descriptions are given of 3 diseases of the cocoanut palms observed by the author in Trinidad.

The first of these, a root disease, is attributed to the fungus *Botryodiplodia* sp., and may be recognized by the yellowing and hanging down of the leaves, by the disorganized condition of the cortex of the roots and the red discoloration in the stem, and by the pustules bearing fungus spores on the dead leaf stalks. This disease may be spread through the soil or by spores. It appears in all soils, but apparently spreads more rapidly and is more destructive in damp, lowlying, undrained regions. To prevent the spread of the disease the author recommends the burning of all diseased trees and rubbish, isolation by digging trenches around diseased trees, cultivation of the land, and spraying with fungicides for the destruction of the spores, as well as applications to the soil for the destruction of the mycelium. Where replanting is necessary it should be done with ripe nuts from disease-resistant trees.

The leaf disease described is caused by a species of Pestalozzia, and may be recognized by yellowish spots on the leaflets, especially near their tips. These spots increase in size, the leaf turns yellow, then brown, and finally dies. When the leaflets of the terminal 2 or 3 ft. of the leaves have died this portion breaks off and hangs vertically downward from the end of the dying leaves. This is said to be one of the most characteristic indications of this disease. Associated with this fungus is another, *Diplodia epicocos*, but experiments seem to indicate that it is saprophytic and only completes the destruction begun by the Pestalozzia. The spread of this disease is accomplished by wind and rain, and efforts should be made to keep the trees in as healthy and vigorous a condition as possible.

The third disease described is termed bud rot disease, and was noticed in several isolated districts. The cause of the trouble is said to be somewhat obscure. The roots and stem of the palm appear healthy, while the bud is involved in a vile-smelling soft rot. In one instance a fungus was found in the advancing margin of the diseased part, but generally bacteria were the only organisms present. Three different species of bacteria have been observed in connection with this disease, but as yet no definite data have been obtained as to how they gain entrance to the tree or whether they are the primary cause of the disease. It is thought that careful cultivation and the prompt destruction of diseased material would tend to keep this disease in check.

The effect of alkaline polysulphids on spraying apparatus, M. Frémont (*Prog. Agr. et Vit. (Ed. l'Est), 28 (1907), No. 11, pp. 329–331*).—Attention is called to the fact that in using alkaline polysulphids as fungicides the solutions attack copper lined spraying apparatus. On this account such apparatus should be heavily tin lined to prevent the injurious action of the fungicide.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Inheritance of acquired characters, A. Weisman and R. Semon (*Arch. Rassen u. Gesell. Biol., 3 (1906), No. 1, pp. 1–27; 4 (1907), No. 1, pp. 1–46*).—The controversy set forth in these articles concerns the old problem of whether acquired characters in animals may be inherited, the negative side of the question being taken up by Weisman and the affirmative by Semon. The latter authority maintains that it is impossible to discuss heredity in an unprejudiced manner so long as it is assumed that acquired characters can not be inherited.

The zoological record, D. Sharp (*Zool. Rec., 42 (1905), pp. LXV+1201*).—As in previous issues of this annual publication elaborate classified bibliographies are given of the literature relating to all branches of zoology. The bibliographies of the various subjects have been worked up by members of the record committee of the council of the zoological society of London. The volume covers the literature published in 1905. It is announced that the volume for 1906 will be a joint production of the international catalogue organization and this committee.

The monthly bulletin of the division of zoology, H. A. Surface (*Penn. Dept. Agr., Mo. Bul. Div. Zool., 4 (1907), No. 10, pp. 353–382, pls. 2*).—Brief recommendations are made regarding the use of carbon bisulphid in combating insect pests of beans, peas, and other seeds; the treatment of San José scale with lime-sulphur wash and commercial insecticides; and the results obtained by commercial orchardists in combating this pest.

Report of the entomologist, C. O. Houghton (*Delaware Sta. Rpt. 1903, pp. 141–159, pl. 1*).—In spraying for San José scale boiled lime-sulphur wash gave better results than the unboiled wash. Pure kerosene did not injure native plum trees, but caused some injury to apple and pear trees. In commercial orchards little difference was seen in the results from the use of boiled and unboiled lime-sulphur washes.

Snowy tree-cricket is reported to have caused injury to the trunk of a plum tree. Brief reports are also made on the Indian-meal moth in jelly, fumigation for the white fly, *Chilocorus similis*, the codling moth, the oyster-shell bark-louse, the mushroom maggot, and the strawberry weevil.

Division of entomology, A. Craw (*Rpt. Bd. Comrs. Agr. and Forestry Hawaii, 2 (1905), pp. 99–166, pls. 2, figs. 11*).—This material has already been noted from another source (E. S. R., 18, p. 352).

Division of entomology, A. Craw (*Rpt. Bd. Comrs. Agr. and Forestry Hawaii, 3 (1906), pp. 139–164, figs. 6*).—A summary is presented of the inspec-

tion work which has been carried on by the division in preventing the ravages of insects and fungus diseases in Hawaii. Brief notes are included on insect pests found on shipments of plants which were held in quarantine. Particular attention is given to a discussion of the various importations of beneficial insects which have been made into Hawaii. Recently considerable effort has been devoted to a study of *Eucoila impatiens* and other natural enemies of the horn fly.

Report of the government entomologist, E. E. Green (*Circs. and Agr. Jour. Roy. Bot. Gard. Ceylon, 3 (1906), No. 22, pp. 287–294*).—Many of the well-known tea pests continued to give trouble during 1906. The use of sulphur against tea mites has been more extensive. The remedy is effective, but some complaints have been made of injury to the tea foliage from its use.

The cultivation of Kickxia rubber has been rendered almost impossible by the attacks of *Caprinia conchylalis*. This pest may be controlled by repeated spraying with arsenicals. Notes are also given on other pests of rubber and cotton.

Attempts are being made to establish apiculture in Ceylon and the government is encouraging the extension of sericulture.

Report of State nursery inspection, J. G. Moore (*Wisconsin Sta. Rpt. 1906, pp. 231–239*).—Thus far considerable success has been had in keeping dangerous insects and fungus diseases in Wisconsin under control. Notes are given on the prevalence and treatment of oyster-shell bark-louse, cottony maple scale, woolly aphis, peach aphis, imported willow weevil, crown gall, apple blight, etc.

Injurious insects and their control, W. T. Clarke (*Alabama Col. Sta. Bul. 139, pp. 20*).—Brief mention is made of the kinds of damage which may be done to cultivated crops by insects. Formulas are given for the preparation of Paris green, arsenate of lead, poison baits, and lime-sulphur wash. Attention is also called to the importance of mechanical methods of destroying insect pests and the use of trap crops for this purpose.

Report of the entomologist, C. P. Gillette (*Colorado Sta. Rpt. 1906, pp. 142–149*).—During the year under report attention was given to the melon louse, grasshoppers, cottony maple scale, oyster-shell scale, peach-twig borer, peach borer, codling moth, etc. An outline is given of the entomological work proposed for the coming year. The field entomologist, E. P. Taylor, reports on practical work in controlling insect pests, the collection of economic insects, inspection of orchards, and attendance at farmers' institutes. It is stated that despite the excellent spraying equipment in Grand Valley, the codling moth does a great amount of harm. This is attributed to a lack in thoroughness of method, deficiency in spraying material, and incomplete knowledge of the life history of the moth.

Some insects injurious to wheat during 1905–6, L. Bruner and M. H. Swenk (*Nebraska Sta. Bul. 96, pp. 36, pl. 1, figs. 14*).—In this account of wheat insects particular attention is given to the Hessian fly, which caused a great amount of damage in Nebraska for a number of years, but diminished in numbers when control methods suggested by the station were put into practice by farmers. The habits and life history of the pest are discussed in detail and the standard methods of control are recommended.

Biological and economic notes are also given on the wheat-stem maggot, frit flies, wheat midge, wheat straw-worms, stalk borer, and grain plant louse.

Report of the entomologist and plant pathologist, W. V. Tower (*Porto Rico Sta. Rpt. 1906, pp. 25–28*).—Some of the orange groves in the island are infested with red scale. A fungus disease has recently been observed to hold this insect in check. One of the most serious pests of the orange is the purple scale, which may be best controlled by the use of lime-sulphur wash. This gives better results than kerosene or crude oil emulsions. Brief notes are also

given on May beetles, orange leaf-weevil, brown scale, and West Indian peach scale.

Attention is being given to the diseases and insect pests of pineapples, bananas, coffee, and sugar cane.

Diseases and insect pests of coffee, J. W. Van Leenhoff (*Porto Rico Sta. Rpt. 1906, pp. 31, 32*).—Leaf weevils which commonly live on larger trees around coffee plantations may fall on the coffee trees and feed upon them, causing considerable damage. The coffee leaf-miner was not as abundant as in previous years. Considerable benefit was noted from the thorough fertilization of infested trees.

Bibliography of Canadian entomology, C. J. S. Bethune (*Separate from Trans. Roy. Soc. Canada, 2. ser., 12 (1906–7), Sec. IV, pp. 55–65*).—A brief bibliography of works relating to Canadian entomology and published in 1905 is presented in an alphabetical order under the authors' names.

The genus Leucaspis, L. Lindinger (*Jahrb. Hamburg. Wiss. Anst., 23 (1905), Beiheft 3, pp. 1–60, pls. 7*).—The literature relating to this genus of scale insects is reviewed in connection with a bibliography of 154 titles. The author discusses the general anatomical features of the genus, with suggestions regarding the relationship of different species, and presents an analytical table for the identification of the various species.

The tobacco thrips, a new and destructive enemy of shade-grown tobacco, W. A. Hooker (*U. S. Dept. Agr., Bur. Ent. Bul. 65, pp. 24, pls. 2, figs. 2*).—In 1904 attention was called to an attack of thrips upon shade-grown tobacco. Other references to injuries of this sort are also noted by the author. The species under discussion in this bulletin is *Euthrips nicotianæ*, which is described as new.

The injury caused by this insect is referred to as white vein on account of the color of the veins of infested tobacco leaves. This is quite distinct, however, from white vein of northern grown tobacco, which is due to some physiological disorder.

The insect appears to be distributed rather widely throughout the Southern States and feeds upon a number of weeds and other plants as well as upon tobacco. Only 12 or 13 days are required for a life cycle during warm weather. The insect hibernates in the adult stage.

The tobacco thrips is most successfully controlled by spraying with kerosene emulsion diluted with 10 parts of water and carefully mixed, since free kerosene will burn the tobacco leaves. The application should be made in the evening. Other insecticides were tried with fairly satisfactory results, but were not as effective as the kerosene emulsion. In addition to the use of this insecticide, it is also suggested that the seed bed should be separate from the field in which the tobacco is subsequently planted.

Surface caterpillars, H. M. Lefroy (*Agr. Jour. India, 2 (1907), No. 1, pp. 42–46, pl. 1*).—The term surface caterpillars is used as equivalent to cutworms and notes are given on a number of these pests which attack plantings of opium, peas, and other crops. In combating them, the best success was had from the use of a poison bait containing 4 lbs. of white arsenic and 8 lbs. of sugar in 6 gals. of water which was used to moisten 80 lbs. of chopped straw.

Locusts (*Rhodesian Agr. Jour., 4 (1907), No. 3, pp. 236–247*).—Large quantities of arsenite of soda have been used in attempts to destroy locusts. This application of arsenical poisons led to some complaints that locust birds were thereby destroyed. An investigation of this question showed that very few if any locust-eating birds are destroyed by feeding upon poisoned locusts. A brief summary is given of the discussion held at a recent intercolonial con-

ference in Pretoria for the purpose of arriving at suitable measures for dealing with the locust pest.

The praying mantis, J. R. INDA (*Com. Par. Agr. [Mexico], Circ. 54, pp. 14, figs. 15*).—The author presents notes on the habits and life history of *Mantis religiosa* and *M. carolina*, with particular reference to the benefits conferred upon agriculture by these insects.

The chief enemies of the apple, E. MARCHAL and POSKIN (*Bul. Agr. [Brussels], 23 (1907), No. 1, pp. 56–90, figs. 38*).—A general review is presented of the insects and fungus diseases which constitute the most important enemies of the apple. Formulas are given for the preparation of suitable insecticides and fungicides.

Orchard and bush fruit pests in 1906, F. V. THEOBALD (*Jour. Bd. Agr. [London], 13 (1907), No. 12, pp. 705–719*).—In certain consignments of imported apples the codling moth was found in considerable numbers. This insect was not as injurious in orchards as during former years. Brief biological and economic notes are given on the pear midge, woolly aphis, hop aphis, various other plant lice affecting currant, gooseberry, strawberry, and apple, oyster-shell bark-louse, etc. During recent years the blackbird has increased greatly and now causes serious damage to bush and orchard fruits.

Mixed sprays for apple scab and codling moth, L. F. HENDERSON (*Idaho Sta. Bul. 55, pp. 27*).—Since apple scab and codling moth are two of the most important enemies of apple orchards it was thought advisable to carry on experiments to determine more satisfactorily certain points regarding the use of mixed sprays combining a fungicide with an insecticide for the control of the two pests by one operation.

It was found that three applications of Bordeaux mixture in ordinary years control apple scab in a satisfactory manner. The use of Bordeaux mixture just when the fruit is setting sometimes causes a russeting of the fruit and it is, therefore, believed that this application of the Bordeaux mixture should be omitted if any. Arsenate of lead, applied three times, gave the best results in the control of codling moth. It was found that the use of bands also assists greatly in the control of this pest.

In connection with thorough spraying it is recommended that apple trees should not be planted closer together than 24 or 25 ft., that thorough cultivation should be adopted, and that a suitable supply of humus and fertilizers should be maintained in the soil.

The apple leaf-miner. A new pest to the apple, C. D. JARVIS (*Connecticut Storrs Sta. Bul. 45, pp. 35–55, figs. 15*).—The apple leaf-miner is well distributed over the eastern part of the United States and Canada, but has not heretofore been regarded as a serious pest of the apple. During the past season, however, it proved in parts of Connecticut to be very injurious to the apple and also fed on the blackberry, haw, raspberry, and other related plants. This insect develops two broods during the season, the second of which is the more important. Hibernation takes place in the caterpillar stage.

The insect is described in all its stages. The larvæ produce mines in the substance of the leaves and are sometimes so numerous as to form large discolored blotches. The eggs are deposited early in June.

It appears that orchards in cultivated soils suffer less from this insect than those which are left in sod. The collection and destruction of the fallen leaves in autumn is recommended, since the insect at that time of the year is found in the substance of the leaves. In most localities the pest has not yet proved serious, but wherever it is abundant attention should be given to the destruction of the leaves in the fall in order to prevent its further spread.

Spraying demonstrations in Nebraska apple orchards, R. A. EMERSON (*Nebraska Sta. Bul. 98, pp. 35, figs. 7*).—The spraying demonstrations reported in this bulletin were carried on in 6 commercial orchards and the sprays were applied at 5 periods, viz., April 23 to May 1, May 7 to 17, May 15 to 26, June 6 to 9, and July 10 to 25. The materials used for spraying were Bordeaux mixture and an arsenical (arsenate of lead, green arsenite, or Paris green).

Upon tabulating the results obtained from these experiments it was found that the average cost of spraying was 21 cts. per tree and that a net value of $1.66 was obtained from the fruit of each sprayed tree as compared with 80 cts. for each unsprayed tree. The returns per acre were about $80 and $40, respectively. It is recommended that in Nebraska apple trees be sprayed with Bordeaux mixture just before the flower buds open, with Bordeaux mixture and an arsenical immediately after the blossoms fall and also 3 or 4 weeks later, and with arsenate of lead on July 20 and August 10.

Spraying for apple diseases and the codling moth in the Ozarks, W. M. SCOTT and A. L. QUAINTANCE (*U. S. Dept. Agr., Farmers' Bul. 283, pp. 42, figs. 7*).—The treatments planned by the authors were designed to control apple scab, apple blotch, leaf-spot diseases, bitter rot, and codling moth. Applications were made just before the flowers opened, just after the petals fell, 7 days later, after another 3 weeks, and on June 25, July 17, and August 11. Bordeaux mixture with an arsenical added was found to be the most effective treatment for the principal diseases of the fruit and foliage of the apple and also for the codling moth. A good quality of Paris green is satisfactory, and when applied with Bordeaux mixture adheres well to the foliage. Arsenite of lime is the cheapest of all the arsenicals used in these experiments.

With varieties of apples ordinarily immune to scab the first application is not necessary, and in localities where bitter rot does not prevail the last application may be omitted.

Insect and fungus enemies of the grape east of the Rocky Mountains, A. L. QUAINTANCE and C. L. SHEAR (*U. S. Dept. Agr., Farmers' Bul. 284, pp. 48, figs. 35*).—The authors, working in cooperation, have devised a treatment which is effective against the grape root-worm, berry moth, curculio, leaf moth, leaf-hopper, leaf-folder, and flea-beetle, the rose chafer, black rot, downy mildew, powdery mildew, anthracnose, ripe rot, bitter rot, white rot, crown gall, and root rot, and against shelling. Brief notes are given on the appearance and life history of these grape pests and on the preparation and application of insecticides and fungicides.

In controlling these pests it is recommended that a first application be made about May 1, using Bordeaux mixture of the formula 6–3–50; a second application about June 1, using Bordeaux mixture with the formula 5–5–50 with an arsenical added, the third application as soon as the blossoms fall, the fourth about 10 days later, and the fifth and sixth at intervals of about 2 weeks, using for the third and fourth applications the Bordeaux mixture and an arsenical, and for the fifth and sixth Burgundy mixture with an arsenical.

Remedies for the San José scale. San José scale act (*Ontario Dept. Agr. Bul. 157, pp. 12*).—For ordinary treatment a lime-sulphur mixture is recommended. For this purpose 3 formulas of the insecticide are presented. Directions are also given for the preparation of crude oil and whale-oil soap. In summer kerosene emulsion or whale-oil soap will give satisfactory results.

A copy is given of an act for the prevention of the spread of San José scale.

The elm-leaf beetle, W. E. BRITTON (*Connecticut State Sta. Bul. 155, pp. 14, pl. 1, figs. 6*).—The biology and economic relations of this insect are briefly summarized. In combating the pest it is recommended that all locations where the beetle might hibernate in an adult stage should be searched in the spring

and the beetles destroyed. The foliage of elm trees should be sprayed with an arsenical as soon as the work of the beetle in the spring can be detected, and later in the season the pupæ may be destroyed by spraying with kerosene emulsion when they collect on the trunk of the trees or in the soil at the base.

The use of sticky bands in combating Lasiocampa pini (*Deut. Landw. Presse, 34 (1907), No. 11, p. 79, figs. 10*).—A brief description is given in connection with illustrations showing a method for applying sticky bands about trees in a rapid and effective manner.

Spraying calendar, S. A. Beach et al. (*Iowa Sta. Bul. 89, pp. 24, figs. 5*).—Directions are presented for methods of controlling the common insects and fungus diseases which injure orchard, garden, and field crops. Recommendations are made regarding the time and method of application of the remedies, and formulas for their preparation are given.

Insecticides and fungicides, L. F. Henderson (*Idaho Sta. Spec. Bul., 1907, pp. 21*).—This is a popular compilation of formulæ and recommendations for the preparation and application of the standard insecticides and fungicides.

The danger from the use of arsenic in agricultural practice, H. Bertinsans and V. Ros (*Rev. Hyg. et Pol. Sanit., 29 (1907), No. 3, pp. 193–217*).—There appears to be no means by which the attacks of leaf-eating insects may be so successfully controlled as by the use of the well-known arsenical insecticides. The necessity of using these insecticides is, therefore, recognized despite the fact that some danger attaches to their use except under proper precautions. After a thorough study of the possible dangers connected with the use of arsenicals the authors propose a set of regulations which they believe will, in large part, obviate these dangers.

It is recommended that the use of arsenate of lead for the destruction of insects be prohibited, and that other arsenical compounds should not be sold except after being colored in such a manner that they can not possibly be confused with any food, condiment, or substance used in the manufacture of wine. The buyer and seller are both to be held equally responsible for this denaturation of the arsenical, and the insecticides are to be sold in packages plainly marked "poison." It is also to be required that dealers shall make monthly reports of the amount of arsenicals sold to their customers together with their names and addresses. Treatments of vineyards with arsenical compounds are not to be authorized except during the first part of the year, and such applications are to be prohibited after the grapes are in bloom. It is also recommended that the public be warned of the danger of eating snails and slugs found in vineyards sprayed with arsenicals.

The Rex spray and other lime and sulphur compounds, L. F. Henderson (*Idaho Sta. Bul. 56, pp. 12*).—A comparative test was made of various forms of lime and sulphur including a proprietary mixture, one recommended by C. V. Piper, and the one commonly known as the California mixture. All of these mixtures proved exceedingly effective in the destruction of San José scale and apparently their effectiveness was about equal. The matter of the relative cost of the different forms of lime and sulphur can be determined only by repetition of the experiments, but it appears that the proprietary form in this case was not more expensive than homemade mixtures when time and labor were estimated at ordinary prices.

Observations on mosquitoes, B. Galli-Valerio and J. Rochaz-de Jongh (*Centbl. Bakt. [etc.], 1. Abt., Orig., 43 (1907), No. 5, pp. 468–477, fig. 1*).—As a result of their study of mosquitoes, the authors believe that a considerable percentage of the mosquitoes which first appear in spring come from hibernating larvæ and eggs. Numerous observations were made on the transportation of mosquitoes by wind and on the various parasites to which they are subject.

A test was made of a large number of substances to determine their value as repellants for mosquitoes. It was found that formalin, oil of cloves, bergamot oil, cinnamon oil, oil of peppermint, and various other essential oils had this effect to a considerable degree. In experiments in the destruction of mosquito larvæ and pupæ in water, it was found that green schist oil as well as petroleum and Bordeaux mixture are of considerable value for practical use. Good results were also obtained from the use of a proprietary antiseptic, depending for its action largely upon the presence of formalin.

Glossina palpalis as an agent in transmitting trypanosomiasis, L. CAZALBOU (*Compt. Rend. Acad. Sci. [Paris], 143 (1906), No. 12, pp. 435–437*).—In experiments with dogs and cats it was found that *G. palpalis* naturally infected with trypanosomes was capable of transmitting the infection to these animals.

Some disease-carrying insects, C. E. CHAMBERS (*Clemson Agr. Col. Ext. Work, 2 (1906) No. 5, pp. 18, figs. 5*).—A brief account is given of the habits and life history of the common house mosquito, malarial mosquito, yellow fever mosquito, and house fly, with special reference to their agency in carrying diseases and to means of combating them.

Ticks in the transmission of diseases, W. DÖNITZ (*Ber. Senckenb. Naturf. Gesell., 1906, pp. 39–52*).—In this discussion particular attention is given to *Ixodes ricinus*, *Boophilus annulatus*, *Rhipicephalus appendiculatus*, *Argas persicus*, and *Ornithodorus moubata*.

A new type of sarcoptic mite parasitic on pupiparous diptera, E. SERGENT and E. L. TROUESSART (*Compt. Rend. Soc. Biol. [Paris], 62 (1907), No. 10, pp. 443–445, fig. 1*).—In Algeria, the domestic pigeon is infested with a parasitic fly known as *Lynchia maura*. This fly is at times apparently parasitized by a mite described as a new genus and species under the name *Myialges anchora*. Since this family of mites is apparently confined to warm-blooded animals, it is suggested that the mite may spend the greater part of its existence on the pigeon and may merely deposit its eggs upon the parasitic fly.

FOODS—HUMAN NUTRITION.

Foods and their adulteration, H. W. WILEY (*Philadelphia: P. Blakiston's Son & Co., 1907, pp. XII+625, pls. 11, figs. 86*).—In this volume, which is designed for manufactures, consumers, physicians, and sanitarians, as well as for the general reader, the author has summarized a large amount of data regarding the methods of preparation and manufacture of animal and vegetable foods, their nutritive value, standards of purity, regulations for inspection, simple tests for adulterants, effects of storage, and related questions. Among the special subjects are meat and meat products, poultry and eggs and game birds, fish foods, milk and milk products and oleomargarine, cereal foods, vegetables, condiments and fruits, vegetable oils and fats and nuts, fungi as food, sugar, sirup, confectionery and honey, and invalids' and infants' foods.

In the form of appendixes, extracts are given from the national laws relating to pure food, as well as rules and regulations for the enforcement of the laws, and official standards of purity. The author calls attention to the fact that all opinions regarding adulterations, misbranding, nutritive value, and wholesomeness are individual expressions and are not to be considered in any other manner.

The volume as a whole constitutes a very interesting and valuable reference handbook and discussion of food and food adulteration.

Food inspection decisions (*U. S. Dept. Agr., Food Insp. Decisions 1–25, pp. 28; 26, pp. 3; 27–30, pp. 4; 31, p. 1; 32, pp. 2; 33–36, pp. 4; 37–38, pp. 2; 39, p. 1; 40–43, pp. 4; 44–45, pp. 3; 46–48, pp. 4; 46 amended, pp. 2; 49–53, pp. 6;*

54–59, pp. 7; 60–64, pp. 6; 65, pp. 16; 66–68, pp. 5).—The decisions which have been rendered under the provisions of the pure food law regarding the scope and meaning of the law; labeling of goods; the scope and purpose of food inspection decisions relative to importation; labeling of whisky, blends, compounds, and imitations; the use of sugar in canned foods; and related questions are taken up in these publications. They are designed to inform importers and exporters of food products and the public generally of the opinions rendered by the Secretary of Agriculture under the existing laws relating to the examination of food products before shipment to foreign countries and to the examination of food products imported into the United States and goods for interstate trade. The last of the publications mentioned contains a detailed list of the subjects taken up to date in the decisions.

Report of food commissioner, E. F. Ladd *(North Dakota Sta. Rpt. 1906, pt. 2, pp. 164, pls. 4).*—Under the provisions of the State pure-food law, canned vegetables, jams, jellies, preserves, maple sirups and sugar, coffee, lard, candies and confectionery, drugs, medicines and beverages, etc., were examined. According to the author, the canned vegetables offered for sale in North Dakota are now of good quality and free from adulteration. "There has not been found on the market in this State a single brand of corn, peas, string beans, or tomatoes during the past year which contained chemical preservatives, saccharin, or coal-tar dyes." Some jams, jellies, and similar goods were found which were not true to name or which were of unsatisfactory character.

"There has been a marked improvement in the character of the maple sirups offered for sale in the State during the past year. . . .

"There has been some improvement in the character of the coffee offered for sale in the State, but there are still abuses which should be corrected. Some of these have sprung up as the result of a popular demand for a particular type of coffee, which as a rule is not to be had in any appreciable quantity, and other grades have been substituted in the place therefor."

While considerable improvement was noticeable, the quality of candies offered for sale in the State was not regarded on the whole as satisfactory, adulteration or sophistication being found in a number of cases.

Lard sold in pails or packages was not infrequently found to be short weight.

"Since the enforcement of the food law in this State there has been a marked improvement in the character of the meat products offered for sale in North Dakota. Formerly preservatives, especially sulphites and borates, were largely employed as preserving agents in meats, but after numerous prosecutions of offenders, not only local butchers but packers as well discontinued the use of preservatives as well as of coloring matter in the meat intended to be sold in this State."

The comparative merits of drawn *v.* undrawn poultry for cold storage are discussed, and, according to the author, the State food department has always intended that poultry should never be thus stored until it has been properly drawn.

Food analyses, E. H. S. Bailey *(Bul. Kans. Bd. Health, 3 (1907), No. 2, pp. 36–39).*—The examination of a number of samples of oysters for copper showed that it was present in amounts ranging from quantities so small that it could not be readily determined to an amount equivalent to 0.09 per cent of copper sulphate.

"In regard to the occurrence of copper in oysters, this has been ascribed to various causes, but there is no evidence that would lead one to believe that it is introduced by the shipper or dealer. . . .

"Although a small amount of copper in oysters may not be an indication that

they are injurious, yet the comparatively large quantity mentioned in some of these cases indicates that such oysters should not be used as food. . . .

"Finally, it is probable that in most cases only harmless quantities of copper are found in oysters, but as far as investigations have gone it would seem that green oysters are to be regarded with suspicion, as their green color may be due to an excess of copper."

The possible harmfulness of copper salts and related questions are discussed. Brief notes are also given regarding the examination of icing materials for confectionery and other products.

Practical observations upon the chemistry of food and dietetics, J. B. S. KING (*[Chicago]: Blakely Printing Co., 1906, pp. 140*).—General principles of nutrition, chemistry of milk, eggs, meat, and other special foods, food for infants, food for old age, diet in various diseases, and related questions are considered.

The inspection of restaurants (*Brit. Food Jour., 9 (1907), No. 99, p. 42*).—In a brief note summarized from a statement in *Medical Press*, the desirability of inspection to insure cleanliness in restaurant kitchens is pointed out and the regulations adopted by the Westminster Council, England, are summarized.

"The rules concern the structure and capacity of the kitchen, the drainage of the scullery, and the ventilation of the premises. No food is to be stored in any place where it may be exposed to infection or contamination; proper enameled stoneware sinks are to be provided for washing vegetables in; all tables and benches are to be provided with wheels so that they may be easily moved, and shelves are to be fitted 2 in. from the walls so that dirt shall not collect in corners. The employees are to have separate places for hanging their outdoor clothes, and every part of the premises is to be adequately lighted."

Studies of the condition of Lombardy peasants, A. MENOZZI and E. GRÜNER (*Ann. Ist. Agr. [Milan], 6 (1901–1905), pp. 1–25, pls. 2*).—The present investigation was made on farms in the province of Milan. The data recorded include a discussion of food supply, sanitation, kinds and amounts of food eaten, and related questions.

Nutrition on an unrestricted diet, S. SUNDSTRÖM (*Skand. Arch. Physiol., 19 (1907), No. 1–3, pp. 78–95*).—The dietary studies reported were made with Finnish students and laborers. The diet of the students supplied on an average 157 gm. protein and 3,984 calories per person per day, that of one group of laborers 114 gm. protein and 3,011 calories, and of the other group, 167 gm. protein and 4,378 calories. In the case of the students, animal food furnished about 75 per cent of the total protein, and in the case of the laborers, some 60 to 66 per cent.

A new chemical test for strength in wheat flour, T. B. WOOD (*Proc. Cambridge Phil. Soc., 14 (1907), No. 1, pp. 115–118*).—In his work on this subject, the author has studied the conditions which influence the volume of the loaf produced from a given weight of flour and especially carbon dioxid production and its relation to the sugar originally present in the flour.

The carbon dioxid evolved was measured and the amount of sugar necessary to produce it was calculated and compared with the quantity found in the flour. The latter quantity was not nearly sufficient to account for all the carbon dioxid evolved by the yeast, but the author believes that the discrepancy may be accounted for by the action of the diastatic enzyms present in the flour and that the determination of the sugar content of flour and its relation to carbon dioxid production is of value in judging baking quality.

Generally speaking, the experiments showed that the amount of carbon dioxid produced had a direct relation to the quality of flour as judged by bakers.

"In applying the above ideas to testing flours, there are clearly two ways of

proceeding: (1) To make chemical determinations of the sugar contained in the flour as such and of the sugar formed by incubating the mixture of the flour and water at such a temperature and for such time as is commonly used in baking (for instance, for 3 hours at 30° C.); (2) to mix the flour with yeast and water and measure the carbon dioxid evolved during the fermentation.

"Of these two methods the latter is very much easier to carry out and, it is suggested, gives very valuable indications of that particular component of strength which is concerned with the volume of the loaf. If this is so, the addition of sugar to flours which make small loaves should produce an increase in size, and this has been found to be the case by actual baking experiments. For instance, in one experiment the addition of 1 per cent of sugar to ordinary household flour as bought in Cambridge was found to make an increase of 2 per cent in the weight and 13 per cent in the volume of the loaf."

Experiments on the nutritive value of different sorts of bread, P. Fauvel (*Rev. Internat. Falsif., 20 (1907), No. 1, pp. 19, 20*).—The author summarizes and discusses the results of his investigations, which showed that breads including the whole of the wheat berry furnished less nutritive material pound for pound than white bread because of their inferior digestibility. The effect of different sorts of bread on the excretion of uric acid, xanthо bodies, urea, and phosphoric acid, and upon the volume and acidity of the urine is spoken of.

The microscopic examination of bread, E. Collin (*Ann. Chim. Analyt., 12 (1907), No. 2, pp. 41–49, figs. 4*).—The results of microscopical examinations of bread of different sorts are reported and illustrated by figures. The author believes that such examination is valuable for the detection of adulteration of bread as with other flour than wheat and may also be used for alimentary pastes.

A contribution to the bacteriological study of bread and biscuits, C. M. Belli (*Gior. R. Soc. Ital. Ig., 28 (1906), No. 6; abs. in Hyg. Zentbl., 2 (1907), No. 12, pp. 359, 360*).—According to the investigations reported, both bread and biscuits or crackers are sterile when taken from the oven. For some time after baking, 22 hours in the case of bread and a month in the case of crackers, the micro-organisms present were few in number. This is an indication, in the author's opinion, that such foods, owing to dryness or dry crust and to any acidity, are not very favorable ground for the growth of micro-organisms, as there is abundant opportunity to acquire them from the air.

Enlargements of micro-photographs of barley grains rich in protein and poor in protein, Lauck (*Wchnschr. Brau., 24 (1907), No. 13, pp. 175, 176, figs. 7*).—The micro-photographs reproduced are of interest as showing the variations in the structure of the grain and the distribution of protein and starch in barley of varying composition.

Comparative tests of German and American oats, E. Haselhoff (*Landw. Vers. Stat., 65 (1907), No. 5–6, pp. 339–347*).—The analytical data reported showed practically no difference in the composition of American and German oats, and in the author's opinion the German oats are as well suited for the manufacture of oat foods as the American.

The extractives of muscles. VIII, The formation of histidin by the cleavage of carnosin, W. Gulewitsch (*Ztschr. Physiol. Chem., 50 (1907), No. 6, pp. 535–537*).—According to the author, carnosin is the first leukomatin which has been recognized as a histidin derivative.

Studies of the lecithin content of myocardium and striated muscles, A. Erlandsen (*Ztschr. Physiol. Chem., 51 (1907), No. 1–2, pp. 71–155*).—The monoamido-monophosphatids—that is, the lecithins of the kephalin group—are best known and perhaps most widely distributed in the body. The composition of the lecithins of beef muscle and heart was $C_{43}H_{80}NPO_9$, these proportions being similar to those for the lecithin of hen's egg yolk. Methods of estimat-

ing lecithin and other questions which have to do with the different radicals present in this substance are discussed at length.

On the changes in certain meat essences kept for several years in tins, G. S. BUCHANAN and S. B. SCHRYVER (*Local Govt. Bd. [Gt. Brit.], Med. Dept., Rpts. Insp. Foods, 1906, No. 1, pp. 11*).—Samples of essence of beef in tins, which were several years old and had been returned from South Africa, were not in good condition, as was shown by the appearance of the cans and can contents. Chemical and physiological studies were therefore made of such goods.

"The only substantial difference that could be detected in the old samples as contrasted with the new was that the former contained appreciable quantities of metal which has been dissolved out from the tin and reprecipitated in insoluble form, whereas the latter was free from such metals. The metal consisted almost entirely of tin with only the smallest traces of lead. . . .

"With regard to the organic contents of the several tins, the general conclusion may be drawn that these have undergone very little change. If products of the nature of meat extracts and essences be put on the market in glass vessels, there is no reason why they should not remain in good condition for indefinite periods, especially when it is remembered that they can be sterilized in small bulk. These remarks are intended to apply only to such bodies as extracts or essences which contain no coagulable protein. They would hardly apply, for example, to such products as meat juices."

When samples of the meat essences properly diluted with physiological saline solution were injected into the peritoneal cavities of rabbits no disturbances were noted. "The old samples were perfectly nontoxic under these conditions."

Oysters, S. J. CRUMBINE (*Bul. Kans. Bd. Health, 3 (1907), No. 2, pp. 40, 41*).—The author insists that oysters should not be floated or fattened and that sanitary measures should be followed when they are shipped in bulk.

"Most people regard the white, plump oyster as preferable to the gray, rather thin oyster. The natural color of the oyster is a dingy gray, sometimes slightly tinged with green or red, according to the locality where grown and the time of year they are gathered. The white plump oyster is the one that is water-soaked and bleached and has lost the 'sea flavor.' The size of the oyster depends in the main on age, the very large ones being from four to five years old."

Note on the value of cocoa as a food and condiment, R. O. NEUMANN (*Arch. Hyg., 60 (1907), No. 3, pp. 175–190*).—The author gives a revision of some of the calculations in his previously published article on this subject (E. S. R., 18, p. 757), but states that the revised figures do not in any way change the conclusions which were reported.

Fresh-water algæ as human food, S. NAMIKAWA (*Bul. Col. Agr., Tokyo Imp. Univ., 7 (1906), pp. 123, 124; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 530, II, p. 884*).—Two edible Japanese marine algæ are described and an analysis of one species is reported.

The digestibility and utilization of some polysaccharid carbohydrates derived from lichens and marine algæ, T. SAIKI (*Jour. Biol. Chem., 2 (1906), No. 3, pp. 251–265*).—By means of artificial digestion experiments and experiments with small dogs and a man, studies were made of the digestibility of the carbohydrates of lichen and algæ, including among others Iceland moss (*Cetraria islandica*), Irish moss (*Chondrus crispus*), and agar-agar. The experiments indicated, in the author's opinion, that the polysaccharid carbohydrates "were not readily transformed to sugar by carbohydrate-digesting enzyms of animal origin and scarcely more readily by vegetable enzyms or bacteria. Correspond-

ing with this, the digestibility and availability of such products in the alimentary tract were found to be very imperfect in both man and animals. The results of these investigations should be applied in criticism of the claims made for some of the 'food preparations' rich in indigestible carbohydrates, and many food materials more properly rated as 'food accessories.'"

The effect of the agar-agar on the total mass of the feces in an experiment with man was very marked. "The agar easily retains water in the alimentary residues and prevents the formation of dry, hard, fecal masses which readily induce constipation. This property of the agar, together with its failure to dissolve readily by digestion or fermentative change has led . . . to . . . its use in appropriate cases of chronic constipation with very satisfactory results."

In one of the experiments with man unboiled Italian chestnuts were added to the regular diet to ascertain the effect of raw starch on the composition of the feces as compared with the algæ carbohydrates. "The results indicate the relative indigestibility of starch offered in this form."

Raspberry juice and marmalade, O. LOBECK (*Ztschr. Öffentl. Chem., 13 (1907), No. 5, pp. 84–90*).—From an examination of a number of samples of raspberry juice and raspberry marmalade, the author concluded that the German goods were superior to the French or the English. Some of the samples examined contained excessive amounts of seed.

The composition of English fermentation vinegars, F. D. RATCLIFF (*Analyst, 32 (1907), No. 372, pp. 85–87*).—Detailed analyses of 11 samples of vinegar are reported. A discussion follows the paper.

The sensation of hunger; its location and cause, L. LUCIANI (*Arch. Fisiol., 3 (1906), No. 5, pp. 541–546*).—A physiological discussion.

Experimental studies on the effect of condiments on the secretion of gastric juice, RHEINBOLDT (*Ztschr. Diätet. u. Phys. Ther., 10 (1906), p. 35; abs. in Hyg. Rundschau, 17 (1907), No. 3, pp. 190, 191*).—Experiments with hospital patients with fistulæ and a dog with so-called Pawlow small stomach led to the conclusion that the soup flavoring studied caused an increased flow of gastric juice with higher acid content. In the case of man this juice had normal digestive powers, but in the case of the dog it was inferior to normal gastric juice in this respect.

The assimilation of iron by nursing children, KRASNOGORSKY (*Jahrb. Kinderheilk., 64 (1906), p. 651; abs. in Zentbl. Physiol., 20 (1906), No. 23, p. 785*).—As shown by a number of experiments, iron of woman's milk was much better absorbed than that of goat's milk and iron in cooked milk better assimilated than in raw. Sixty per cent of the iron in spinach and egg yolk was assimilated. A considerable part of the iron of commercial preparations was also found to be assimilated, though such goods were inferior to the mothers' milk, spinach, and egg yolk in this respect.

Percentage composition and relative money value, digestibility and use of food, J. KÖNIG (*Prozentuale Zusammensetzung und Nährgeldwert der menschlichen Nahrungsmittel nebst Ausnutzungsgrösse derselben und Kostsätzen. Berlin: Julius Springer, 1906, 9. ed., pp. 8, charts 4; rev. in Hyg. Zentbl., 2 (1907), No. 9, pp. 256, 257*).—A revised edition of this series of food charts with explanatory text.

Concerning digestibility and especially the digestibility of protein, W. GRIMMER (*Biochem. Ztschr., 2 (1906), No. 2, pp. 118–143*).—The author's investigations with horses are reported and discussed in comparison with similar work of other investigators.

The acidity of the mixed stomach contents he found to be low at the beginning of digestion owing to the large amount of alkaline saliva present. It increases gradually and after about 45 minutes becomes nearly constant, being

equivalent to about 0.3 per cent hydrochloric acid. As a matter of fact, however, the hydrochloric acid actually present is much less than this quantity, as the acidity is largely due to lactic acid or later to peptones. The material in the small intestine during the entire period of digestion has an alkaline reaction equivalent on an average to about 0.13 or 0.14 per cent sodium carbonate.

The digestion and resorption of nutrients in the stomach and intestine increased as the digestion progressed. As regards the protein cleavage products in the stomach when oats were fed, syntonin was present in large quantities at the beginning of the digestive period, constituting in amount over one-third of the total soluble nitrogen. The proportion of syntonin later on decreased. The quantity of albumoses of different sorts increased from the beginning of the digestive period until a maximum was reached and then diminished. At the beginning of the period the amount of peptone present was very small and it was not formed in large proportion in the stomach until after 3 hours. It may be said that peptone is practically the only cleavage product which is absorbed in the stomach, and peptones and crystalline cleavage products in the small intestine.

Concerning creatin and creatinin in metabolism in man, K. O. af Klercker (*Biochem. Ztschr., 3 (1907), No. 1, pp. 45–87, figs. 6*).—From the experimental data reported the author concludes that it is very questionable whether there is any biological relation between creatin and creatinin.

When they are taken into the body both may be in part excreted unaltered through the kidneys and no change from one to the other takes place in the body. Creatinin is the more readily and completely excreted in the urine. Since exogenous creatin is not changed to creatinin in the body and since, further, the ordinary diet supplies only traces of creatinin, the quantity in the urine must be of endogenous origin, but the way in which it is formed in the body is not known. A relationship between it and the creatin of the muscular system is not proved and does not seem probable. Since creatin can not be regarded as a cleavage product of protein taken in the diet, there seems hardly any alternative except to regard it as a special metabolic product.

The physiological action of muscle extract, J. G. Slade (*Jour. Physiol., 35 (1907), No. 3, pp. 163–181, figs. 10*).—To determine the effect of such materials as meat extract, a number of experiments are reported, in the majority of which a special extract, prepared in such a way that it contained practically no salts nor proteids, was used. Tests were also made with some of the known constituents of muscle extract, such as xanthin, creatin, and urates. The conclusions which were drawn follow:

"Muscle extract has no stimulant action upon the central nervous system, nor upon the power of doing physical work, in man. If it be taken as a strong solution and in large amounts it is liable to cause purgation. In moderate doses it increases the rate and activity of the heart. This is not due to creatin, xanthin, or urates. The vessels are constricted. After small doses there is initial dilatation. The movements of plain muscle throughout the body are increased. Probably this is due to ornithin and novain.

"Muscle extract in 0.5 per cent solution increases the work of voluntary muscle; in 0.1 per cent solution it has no effect upon the efficiency of the muscle; in 2 per cent solutions it decreases the work. Xanthin has an action corresponding to the first effect—that is, in saturated solution (1-2500) it increases the work. Creatin has no action on voluntary muscle.

"The effect of fatiguing a muscle before preparing an extract from it is to increase its extractives and increase the activity of the extract. If injected into animals it causes great languor, prostration, and all the symptoms characteristic of fatigue. Muscle extract administered as 'beef-tea' acts as

a moderate diuretic to men and other animals. The diuresis is associated with vaso-dilatation of the kidney."

The excess of energy due to the elimination of protein and its measurement, A. CHAUVEAU (*Compt. Rend. Acad. Sci.* [*Paris*], *144* (*1907*), *No. 5, pp. 237–243*).—The measurements of energy reported during the digestion and utilization of different nutrients showed, according to the author, that more energy is given off as heat when protein is assimilated than is the case with other nutrients. In general, the energy expenditure of a fasting subject is augmented when the subject is fed, by the energy necessary for the digestion, absorption, and assimilation of nutrients.

The different nutrients do not require the same expenditure. Variations of this character are shown and explained very well in the case of assimilation, which is accomplished by the incorporation of food potential into reserve fat. With carbohydrates and fat the incorporation is accomplished economically, the fat having only to be adapted to its new situation, while the carbohydrates have to be converted into fat by a simple process that is practically neutral from a thermic point of view. With respect to protein the transformation into fat is much more difficult. The production of the fat reserves at the expense of the food proteid explains, therefore, very well the greater energy expenditure connected with the usage of the meat ration. This production results in an incomplete oxidation (to urea) of the potential proteid, an oxidation which liberates a notable quantity of energy without other utilization than that of the chemical metabolism for which the energy is employed.

With very large meat rations the actual energy thus employed for the formation of reserves of fat has a considerable value, but the ration need not be excessive for the process of transformation of protein and fat to occur. Even in small quantity the protein of the ration fulfills its double destiny of working for the renovation of the tissues and of concurring in the maintenance of a fat reserve. The result of this is that the greater expenditure of energy connected with a meat diet manifests itself clearly in the case of subjects nourished with rations capable only of maintaining an equilibrium of nutrition.

All of these facts are incompatible with the principle of isodynamic substitution. The nutritive value of the nutrients is not to be sought in their heats of combustion. The theory of food and nutrition can no longer be presented in such simple fashion.

Concerning protein metabolism, J. HÄMÄLÄINEN and W. HELME (*Skand. Arch. Physiol.*, *19* (*1907*), *No. 1–3, pp. 182–200*).—When egg white, "protone," and roast veal were each added to a basal ration it was found that the excretion of the extra nitrogen was slower on the egg diet than on the other diets. Similar results were also noted with the sulphur excretion, the extra sulphur of "protone" and veal being recovered in 2 or 3 days as compared with 6 days in the case of the egg white. The experimental data are not regarded as sufficient for general deductions regarding the excretion of phosphorus.

The chemical mechanism of protein assimilation, C. INAGAKI (*Ztschr. Physiol. Chem.*, *50* (*1907*), *No. 6, pp. 449–471*).—Experiments made with cells and isolated cell nuclei led to a number of general conclusions. According to the author, nucleohiston unites with albumoses and forms salt-like bodies when it is in a free or dissociated condition, and it follows that albumoses formed in the body or artificially introduced into the circulation can be taken up or fixed by the cell substance.

Nitrogen balance on a mixed ration low in protein, G. SPADARO (*Arch. Fisiol.*, *3* (*1906*), *No. 5, pp. 533–538; abs. in Zentbl. Physiol.*, *20* (*1906*), *No. 23, p. 789*).—The author found that in a 4-day experimental period he was practically in nitrogen equilibrium on a mixed diet supplying 15.3 gm. nitrogen per

day. The nitrogenous constituents of the ration were then increased to what he considered the limit of tolerance, 500 gm. meat and 140 gm. cheese, and after a preliminary period of 9 days an experiment covering 4 days was made. Although the diet furnished 32.7 gm. nitrogen per day, nitrogen equilibrium was not reached, there being an average daily loss of 1.1 gm. nitrogen.

Gelatin as a substitute for protein, P. RONA and W. MÜLLER (*Ztschr. Physiol. Chem., 50 (1907), No. 4–5, pp. 263–273*).—In the experiments reported, which were made with dogs, gelatin was supplemented by tyrosin and tryptophan, and confirmed the opinion that gelatin nitrogen may replace 20 per cent of the proteid nitrogen of the diet. The adding of the amido acids (tyrosin and tryptophan) did not increase the substituting value of the gelatin.

Has the amount of soluble nitrogenous compounds in wheat flour an effect upon baking value? W. BREMER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 2, pp. 69–74*).—The experimental data reported indicate that it is doubtful whether the soluble nitrogenous constituents affect baking quality.

The influence of lecithin upon the action of digestive ferments, S. KÜTTNER (*Ztschr. Physiol. Chem., 50 (1907), No. 6, pp. 472–496, dgm. 1*).—In some cases lecithin increased and in others diminished the action of both peptone and pancreatic ferments. No explanation of this was found, but the author states that his experiments are to be continued.

The excretion of sodium chlorid and nitrogenous material through the skin, SCHWENKENBECHER and SPITTA (*Arch. Expt. Path. u. Pharmakol., 56 (1906), pp. 284–300; abs. in Chem. Zentbl., 1907, I, No. 11, p. 832*).—According to the authors nearly the same quantities of sodium chlorid and nitrogen are excreted through the skin, the value for each being about 0.33 gm. for 24 hours in the case of a healthy man lying in bed. If excessive secretion is induced by heat, by pilocarpin, or by certain diseases, the excretion of sodium chlorid is diminished to 0.05 per cent.

The transformation of formic acid and formates and their elimination, C. FLEIG (*Compt. Rend. Acad. Sci. [Paris], 144 (1907), No. 7, pp. 386–388*).—The formation of carbonates from formates in the animal body under different conditions was the subject of the author's investigations.

Cooking utensils injurious to health, O. SCHÜTTE (*Pure Products, 3 (1907), No. 4, pp. 163–169*).—Possible dangers from the use of metal and other cooking utensils are spoken of with special reference to conditions which exist in different countries.

ANIMAL PRODUCTION.

Practical details of vital significance in the utilization of corn fodder. Silage from dried corn fodder, A. T. NEALE (*Delaware Sta. Rpt. 1903, pp. 36–40*).—Brief statements are made regarding the steam husker and fodder shredder and as to the air-blast elevator and its use in making circular stacks and ricks. Tests were undertaken to determine approximately the completeness of separation by the air blast of the blade and top fodder from the coarser portions of the stalk, but were not carried out to the author's entire satisfaction, though in one instance a separation into light and heavy portions, i. e., into blades and coarser material, was accomplished.

Formerly good results were obtained locally by feeding cut fodder packed into boxes, moistened with hot water, and allowed to stand for 24 hours. "The concentrated feeds, say cotton-seed meal, can be mixed with this mass and one of the reasons for purchasing bran can thereby be avoided."

This method is too inconvenient for general use, but it suggested the possibility of making silage from dried fodder, and several successful experiments are reported on the conversion of dried corn fodder into silage by the addition of

water and subsequent fermentation. A rise in temperature was noted in the silos and the development of an aromatic odor as in the case of green silage. It was noted that both young and old stock ate such silage practically without waste, and that cows preferred it to dried shredded fodder. "It is a better and a safer mass to use with cotton-seed meal than dried fodder or hay. The meal adheres to the damp fodder, can not be separated from it by the stock, mastication is insured, and impaction of cotton-seed meal prevented. . . .

"In this experiment the quality of the fermented product varied. Where the moisture content was normal the aromatic odor above noted was present. No points of excessive moisture were found. Fodder in the bottom of the silo was not as moist as that nearer the top. In places channels had formed through which the water, pumped upon the surface, had flowed, leaving masses of only partially moistened fodder in which, to a limited extent, a musty smell and visible mold in extreme cases were noted. This was also the case in the product stored in immediate contact with the cemented lining of the silo, a condition also likely to exist in silage made from green cornstalks.

"The fact that fire risks were noticeably decreased by moistening the fodder corn was patent to all observers."

Calculated loss from the heating of moistened corn fodder, C. L. Penny (*Delaware Sta. Rpt. 1903, pp. 40, 41*).—In connection with the studies noted above on silage making from dried corn fodder moistened with water, the loss of material from the fermentation of the silage was calculated.

According to the author, "100 lbs. of the fodder would lose 2.81 lbs. of starch, or its equivalent, to produce through its complete fermentation the necessary heat to raise the temperature of the mass to 165° F., and this amount, 2.81 lbs., is just 6 per cent of the total dry matter of the fodder."

Bacteriological studies of ensiled forage, C. Gorini (*Ann. Ist. Agr. [Milan], 6 (1901–1905), pp. 105–122, pls. 2*).—The results are reported of a study of the bacteria present in forage preserved in silos.

Feeding saccharified starch, J. Hansen (*Illus. Landw. Ztg., 27 (1907), No. 15, p. 130*).—Starch in the form of starch paste, when converted into sugar by the action of a diastatic ferment, was found to be a valuable material for supplementing skim milk in calf feeding. The relative economy of treating starch with the diastase and related questions are spoken of, the article as a whole being a summary of a paper presented before the German Dairy Society.

A method for the preparation of a preservable dry fodder from yeast (*Pure Products, 3 (1907), No. 3, p. 123*).—Compressed waste yeast from breweries, it is stated, may be converted into a feeding stuff of good keeping qualities by heating such material to which common salt has been added, to about 70° for some 5 minutes. This converts it into a gelatinous mass, which combines readily with other materials and may be mixed with such feeds as spent hops, malt sprouts, grain, beet chips, etc. The treated yeast possesses little enzymatic power. If chopped straw constitutes a part of the mixture the mechanical condition is improved and the material dries more readily.

The feeding stuff control law, A. Goss and W. J. Jones, Jr. (*Indiana Sta. Circ. 6, pp. 10*).—The text of the Indiana feeding-stuff law is given, together with suggestions as to the way manufacturers and dealers may best comply with its requirements. The law, which is similar in its scope and administration to the State fertilizer law, provides for the filing of samples with the State chemist and their analysis, the fixing of labels or tags, the filing of sworn statements by manufacturers, importers, dealers, and agents of the quantity and kind of commercial feeding stuffs sold, and for the punishment of violations of the law by fines.

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Animal industry in Belgium in 1905 (*Bul. Agr. [Brussels], 23 (1907), No. 2, pp. 162–171*).—A summary of statistics regarding the horses, cattle, pigs, and sheep in different Belgian provinces.

Calves for the dairy interests, A. T. NEALE (*Delaware Sta. Rpt. 1903, pp. 35, 36*).—The possible profits to be obtained in raising young cows for sale in dairy districts and in raising young stock of beef types for fattening on surplus corn are discussed.

The production of winter lambs, G. C. HUMPHREY and F. KLEINHEINZ (*Wisconsin Sta. Rpt. 1906, pp. 47–55, figs. 4*).—Four grade ewes, 1 pure-bred Hampshire and 1 pure-bred Southdown ewe in pasture during the summer were bred to a Southdown ram. Early in the winter the ewes were taken to the sheep barn. The lambs were dropped about the 15th of December. At lambing time and for some 3 weeks afterward the ewes and lambs were kept in warm pens. During the trials the ewes were fed a mixture of oats, bran, and oil meal 20 : 10 : 1 with alfalfa hay and corn silage, the total cost of their winter feed to the close of the test being estimated at $3.98 each. After the lambs were taken from the lambing pen to the sheep barn they had access to alfalfa hay and were fed bran, oats, corn meal, and oil meal 4 : 2 : 2 : 1. The average weight of the lambs at birth was 8.7 lbs., and they were sold at an average age of 59.5 days, at an average weight of 41.7 lbs. The calculated net profit per lamb was $7.26. On an average the dressed weight was 52 per cent of the live weight. Other data regarding the slaughter test are recorded.

"In conclusion it may be said that the most disappointing feature of this trial was the failure to get more ewes to breed early enough to produce winter lambs. Where one can secure grade or pure-bred Dorset ewes and have them in good condition, there seems to be little question about their breeding in July, while with the other breeds, one can not depend upon them, and it is only in exceptional cases that they will breed at that season of the year. The use of the Southdown ram gave compactness and excellent mutton quality to the lambs, and the cross is one which can be recommended. The price received for the lambs was extraordinary, but it emphasizes the fact that it pays to produce something of special value and cater to a high-class trade which demands only the best."

Earlier work has been previously reported (E. S. R., 18, p. 263).

Dried beet pulp for lambs, G. C. HUMPHREY and F. KLEINHEINZ (*Wisconsin Sta. Rpt. 1906, pp. 56–59*).—When 10 lambs were fed whole oats and dried beet pulp 1 : 1 with clover hay ad libitum, the average gain per head in 13 weeks was 22 lbs., as compared with an average gain of 22.2 lbs. in the case of a similar lot fed under the same conditions a grain ration of whole oats and shelled corn 1 : 1. The grain eaten per pound of gain on the dried beet pulp was 4.14 lbs. and the coarse fodder 8.01 lbs. Similar values for the corn ration were 4.10 and 7.94 lbs., respectively. Ten days before the close of the trial the lambs were sheared, the dried beet pulp lot yielding 85.5 lbs. of wool and the corn fed lot 80.9 lbs. The feeding stuffs used were analyzed.

"It may be said that both feeds were satisfactory and practically equal for producing growth when used in connection with whole oats and clover hay. The health and the condition of the 2 lots were all that could be desired. . . . Dried beet pulp costs in the neighborhood of $15 per ton. Its economical use will depend on the price of corn. Last winter the shelled corn cost about $18 per ton, which made the ration of beet pulp and oats considerably more profitable."

Whole corn compared with corn meal for fattening pigs, with summary of trials for ten years, W. A. HENRY and D. H. OTIS (*Wisconsin Sta. Rpt.*

1906, pp. 18–32).—Continuing earlier work (E. S. R., 18, p. 266), 3 tests are reported.

In the first, corn (both whole and ground) and wheat middlings 1:1 with 2 lbs. of skim milk per head daily were fed. The total gain in 12 weeks made by the 12 pigs fed the whole-corn ration was 1,205 lbs. and by the similar lot fed the ground-corn ration, 1,298 lbs. The 2 lots required 3.60 and 3.66 lbs. of grain and 1.66 and 1.54 lbs. of skim milk per pound of gain, respectively. In the second test corn (whole and ground) and wheat middlings 2:1 without skim milk were fed for 12 weeks to 2 lots of 5 pigs each. On the whole-corn ration the total gain was 549 lbs. and the grain eaten per pound of gain 4.71 lbs. Similar values for the lot fed the corn-meal ration were 701 lbs. and 4.42 lbs. In the third trial the shelled corn and corn meal, supplemented in each case by wheat middlings, were compared with 2 lots of 6 pigs each, pastured on rape. On the whole-corn ration the total gain was 711 lbs. and on the corn-meal ration 909 lbs., the grain eaten per pound of gain being 4.90 and 3.99 lbs., respectively.

Considering the 10 years tests as a whole, the average gain on whole corn has been 768 lbs. per lot of 8 pigs, and on corn meal 883 lbs., the feed eaten per pound of gain in the 2 cases being 5.01 and 4.71 lbs., or an economy of 6 per cent in favor of the ground grain.

"Where there is plenty of time for maturing the pigs, and it is not necessary to secure the maximum daily gain, it is doubtful if it pays to grind corn for pigs. The test shows that where quick maturity is an important item better results are secured from the corn meal. Pigs fed corn meal eat more grain and make somewhat larger daily gains. Corn meal can doubtless be used to good advantage in finishing off a bunch of hogs which were first fed shelled corn. Changing over to corn meal near the close of the feeding period also furnishes a change in the character of the ration which will be satisfactory to the animals.

"There are conditions and circumstances where it is not advisable to grind the corn even though the corn be high priced. On the other hand, when fitting hogs for show, sale, or in high-pressure feeding for market, the feeder will consider it advisable to grind the corn, even though it is expensive to do so. The feeder, knowing these results, will use them to suit his own conditions."

Soy-bean meal versus wheat middlings as a supplement to corn meal for growing and fattening pigs, G. C. Humphrey and J. G. Fuller (*Wisconsin Sta. Rpt. 1906, pp. 33–41, fig. 1*).—When corn meal and soy-bean meal 2:1 were compared with a like proportion of corn meal and wheat bran with 2 lots of 5 pigs on rape pasture, the average daily gain in 12 weeks on the soy-bean-meal ration was 0.75 lb. per head and on the wheat-middlings ration 0.73 lb. Skim milk was fed with the grain and in the last half of the period was mixed with it in equal amounts to form a thick slop. The 2 lots consumed per pound of gain 3.06 and 3.05 lbs. grain and 3.34 and 3.35 lbs. skim milk, respectively, quantities which are practically the same. The pigs were then taken off the pasture and given the same grain and skim-milk rations in pens for 12 weeks. The average daily gain on the soy-bean-meal ration was 1.32 lbs., and 3.57 lbs. each of grain and skim milk was consumed per pound of gain. With the lot fed wheat middlings the average daily gain was 1.23 lbs. per head, 3.85 lbs. of both skim milk and grain being consumed per pound of gain. As shown by a slaughter test, there was practically no difference in the percentage of dressed weight for the 2 lots. The kidney fat in the lot fed the soy-bean ration constituted 3.3 per cent of the total carcass and in the wheat-middlings lot 2.9 per cent. The feeding stuffs used were analyzed.

"Soy-bean meal mixed with corn meal in the proportion of 1:2 produces greater gains than wheat middlings and corn meal fed in the same proportion.

In feeding equal amounts of the 2 rations, soy beans and corn meal supply a slightly higher per cent of dry matter and digestible matter than wheat middlings and corn meal.

"For firmness, fine grain and texture of flesh, and even distribution of fat and lean, the ration of wheat middlings and corn meal is superior to that of soy beans and corn meal."

Earlier work has been reported (E. S. R., 18, p. 266).

Liquid food for young pigs and other young animals, E. Thierry (*Jour. Agr. Prat., n. ser., 13 (1907), No. 15, p. 464*).—A discussion of the value of hay tea, porridge from rice or other cereals, and meat broth for feeding young animals.

Work of the department of horse breeding, A. S. Alexander (*Wisconsin Sta. Rpt. 1906, pp. 288–291*).—A brief note on the station work on horse breeding, most of which is summarized from a previous publication (E. S. R., 18, p. 764).

DAIRY FARMING—DAIRYING—AGROTECHNY.

The university dairy herd, 1905–6, G. C. Humphrey and F. W. Woll (*Wisconsin Sta. Rpt. 1906, pp. 60–90, dgms. 2*).—The records of the station herd during the year are reported and discussed in the same form as in the previous report (E. S. R., 18, p. 273).

The herd comprised 32 cows representing Jersey, Guernsey, Holstein, Shorthorn, Red Polled, and Brown Swiss breeds. Three cows added to the herd during the year are described. The tabulated data show the amounts of the different kinds of feeds consumed and the milk and butter produced by 30 cows for which a full year's record was obtained. The average yield for the herd was 7,328.6 lbs. of milk and 303.54 lbs. of butter fat. The largest yield of butter fat, 449.73 lbs., was produced by a grade Red Polled cow. The average net profit per head was $41.20 as compared with $35.20 during the preceding year.

The average production of the 30 cows by breeds was as follows: Jersey (7 cows), 6,247.7 lbs. of milk and 318.46 lbs. of butter fat; Guernsey (7 cows), 6,461.1 lbs. of milk and 306.56 lbs. of butter fat; Holstein (7 cows), 10,176.4 lbs. of milk and 346.34 lbs. of butter fat; Shorthorn (3 cows), 4,967.7 lbs. of milk and 185.36 lbs. of butter fat; Red Polled (4 cows), 7,712.3 lbs. of milk and 300.07 lbs. of butter fat; and Brown Swiss (2 cows), 6,954.3 lbs. of milk and 275.19 lbs. of butter fat. The average butter fat production of these breeds for 1898 to 1906 was as follows: Jersey, 312.6 lbs.; Guernsey, 297 lbs.; Holstein, 337.5 lbs.; Shorthorn, 264.7 lbs.; Red Polled, 295.5 lbs.; and Brown Swiss, 278 lbs.

As in previous reports, a comparison was made of the different cows by types. The data are considered unfavorable to the dual-purpose type.

Analyses were given of the feeding stuffs used. In general it was found that a high production was associated with the feeding of a ration containing a large amount of dry matter or digestible protein and a narrow nutritive ratio.

The value of individual records of dairy cows, B. E. Carmichael (*Ohio Sta. Circ. 67, pp. 10, figs. 3*).—The records of 2 cows for 3 years are presented in this circular for the purpose of illustrating the value of accurate knowledge concerning the production of each cow in the dairy herd. One cow produced on an average for 3 years 5,754.9 lbs. of milk and 330.2 lbs. of fat at a profit of $50.72 over cost of food, and the other cow 7,365.1 lbs. of milk and 231.4 lbs. of fat at a profit of $24.82. These are not believed to be extreme differences, but such as might be found in average untested dairy herds.

Roots supplementary to silage for dairy cows, R. S. Shaw and H. W. Norton, Jr. (*Michigan Sta. Bul. 240, pp. 19–31*).—Three feeding experiments

were conducted for the purpose of determining if the addition of roots to a complete ration containing silage would increase profitably the yield of milk. The first experiment was made in the spring of 1905 with 2 lots of 8 cows each and lasted 6 weeks. The second experiment was made in the spring of 1906 with 2 lots of 7 cows each and lasted 8 weeks. The third experiment was also made in the spring of 1906 with 2 lots of 5 cows each and lasted 8 weeks.

The results of the three experiments showed that the addition of roots to a complete ration, consisting of silage, clover hay, and grain increased the yield of both milk and butter fat but not sufficiently to compensate for the increased cost of production. When roots are fed, the increase in cost of milk was 4.2 cts. per 100 lbs. and the increase in cost of butter fat was 1.16 cts. per pound. The fat content of the milk was not affected. The increase in the live weight of the animals was greater when roots were fed, but the difference was not very marked.

A new milking machine (*Umschau, 11 (1907), No. 12, pp. 233, 234, figs. 2*).—A new hand milking machine is illustrated and described.

The feeding of sheep for the production of Roquefort cheese, E. Marre (*Prog. Agr. et Vit., 24 (1907), No. 15, pp. 451–454; Prog. Agr. et Vit. (Ed. l'Est), 28 (1907), Nos. 16, pp. 475–480; 17, pp. 506–512; 18, pp. 528–535*).—This discussion is based upon information obtained from numerous sheep raisers in the region of Roquefort.

The inspection of milk production, A. Monvoisin (*Rev. Gén. Lait, 6 (1906), No. 6, pp. 131–137*).—The author discusses the needs and methods of milk inspection.

The inspection of milk, P. Adam (*Rev. Sci. [Paris], 5. ser., 7 (1907), No. 16, pp. 495–499*).—This is a discussion of the judging of the purity of milk by means of analytical and other data.

Ammonia in milk and its development during proteolysis under the influence of strong antiseptics, H. C. Sherman et al. (*Jour. Biol. Chem., 3 (1907), No. 2, pp. 171–175*).—The results of the investigations are summarized by the authors as follows:

"Analyses of a large number of samples of mixed milk as sold in New York City showed an average of 0.0004 per cent of ammonia preformed at the time of examination together with an additional 0.0003 per cent of what is here called 'cleavage' ammonia.

"When ordinary milk is allowed to become stale the amounts of both preformed and 'cleavage' ammonia usually increase.

"Addition of 3 per cent of chloroform or 0.1 per cent of formaldehyde retards but does not stop proteolysis which results in the formation of ammonia. The production of those proteolytic products to which the 'cleavage' ammonia is due appears to be retarded by these antiseptics to a greater extent than is the production of ammonia itself.

"The greater the freedom from contamination the less apparent is the influence of the antiseptic upon the development of ammonia, and in a sample of exceptional purity spontaneous souring in the absence of preservative treatment appeared to inhibit the production of ammonia to a greater extent than did the addition of 3 per cent of chloroform or 0.1 per cent of formaldehyde."

A bacteriologic comparison of milk served in bottles and by the "dip" method, H. O. Way (*Reprint from Cleveland Med. Jour., 1907, pp. 8*).—Bacteriological examinations were made of bottled milk and milk dipped from cans in the ordinary way. The samples were obtained from 7 dealers in Cleveland, Ohio. Forty comparisons were made.

The milk dipped from cans was found to contain on an average 37 per cent more bacteria than the bottled milk. Eight samples of the dipped milk contained over 300 per cent more bacteria than the corresponding bottled samples. In 8 other comparisons the difference exceeded 50 per cent. Only 3 of the bottled samples contained over 50 per cent more bacteria than the dipped milk. The dipped milk contained a greater number of bacteria than 77.5 per cent of the samples examined. The bacterial content of the dipped milk as compared with that of the bottled milk was increased several hundred per cent by dry, windy weather.

Investigations on the action of rennet upon milk and feeding experiments with calves, F. PRYLEWSKY (*Milchw. Zentbl., 3 (1907), No. 3, pp. 81–113; abs. in Rev. Gén. Lait, 6 (1907), No. 7, pp. 165, 166*).—The author discusses the nutritive value of milk and reports experiments in which various salts were added to boiled milk for the purpose of restoring the coagulability of the milk with rennet.

Sodium chlorid added in the proportion of 1 to 2 gm. per liter retarded coagulation but exercised a favorable influence on the curd. Calcium chlorid, 3 to 4 gm. per liter, accelerated coagulation and made a firmer curd than sodium chlorid. Trisodic citrate gave negative results. The tribasic citrates of calcium and magnesium produced the same effects as sodium and calcium chlorids. Sodium and potassium phosphates gave bad results. The three calcium phosphates gave favorable results but doubled the time required for coagulation. Calcium carbonate, 2 gm. per liter, hastened coagulation. An acid reaction rendered so by the development of lactic acid or the addition of hydrochloric acid was favorable to coagulation. A mixture of sodium chlorid, calcium chlorid, and hydrochloric acid, or of the calcium phosphates was more efficacious than the use of these substances singly.

The feeding experiments with calves showed that the addition of sodium chlorid was very advantageous, even when added to raw milk. Calcium chlorid and the monocalcic and tricalcic phosphates were not favorable to an increase in live weight.

In an experiment lasting 10 weeks, 3 calves were fed boiled milk to which 0.18 per cent of dicalcic phosphate had been added. Three were fed boiled milk containing 0.15 per cent tricalcic phosphate and 3 were fed raw milk preserved with formalin in the proportion of 1 : 10,000. The increase in live weight was greatest with the lot fed milk containing the tricalcic phosphate and least with the lot fed the milk preserved with formalin.

The experiments seem to indicate that boiled milk is not less favorable to the growth of calves than raw milk, and that in the case of boiled milk the addition of certain salts capable of restoring the power of the milk to coagulate with rennet may be made with advantage.

Development of factory dairying in Wisconsin, H. L. RUSSELL and U. S. BAER (*Wisconsin Sta. Rpt. 1906, pp. 100–106, map 1*).—This is a summary of Bulletin 140 of the station previously noted (E. S. R., 18, p. 770).

Apparatus for the simultaneous skimming of milk and the churning of the cream, O. KASDORF (*Rev. Gén. Lait, 6 (1907), Nos. 6, pp. 122–130; 7, pp. 145–154; 8, pp. 169–179; 9, pp. 201–211, figs. 13*).—The various forms of apparatus of this kind are described and illustrated.

Butter classification, M. A. O'CALLAGHAN (*Agr. Gaz. N. S. Wales, 18 (1907), No. 3, pp. 223–227, pls. 4, fig. 1*).—The author discusses the examination of butter for export, commenting upon the fishy flavor due to *Oïdium lactis* and giving illustrations of numerous plate cultures of fish butters.

The water content of margarin, P. BUTTENBERG (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 9, pp. 542–544*).—The average water content of 148

samples of margarin from 18 factories was 14.90 per cent, the maximum 19.95 and the minimum 8.80. Of this number 105 contained more than 16 per cent.

Distribution of lactose-fermenting yeasts in dairy products, E. G. HASTINGS (*Wisconsin Sta. Rpt. 1906, pp. 107–115*).—The dairy products examined for the presence of lactose-fermenting yeasts included milk, whey, butter, and cheese. The yeasts were found to be widely distributed in Swiss, brick, and Cheddar cheese factories. They were also present in about one-fourth of the samples of butter examined and in 29 out of 51 samples of milk.

The main sources of infection are believed to be the soil proper and accumulations of dirt protected from drying. This type of yeast is not considered of economic importance except in certain branches of dairying. In Swiss and brick cheese factories infection with lactose-fermenting yeasts has, in several instances, caused considerable trouble. The danger from infection with this organism is not so apt to occur in Cheddar cheese making.

Milk, cream, butter, cheese, L. LINDET (*Rev. in Rev. Gén. Lait, 6 (1907), No. 9, pp. 211, 212*).—A chapter is devoted to each of the subjects in the title. The composition of milk, methods of analysis, and the principles and practice of butter making and cheese making are discussed.

Directions for making the Camembert type of cheese, T. ISSAJEFF (*Connecticut Storrs Sta. Bul. 46, pp. 57–75, figs. 10*).—The author describes the equipment necessary and gives detailed directions for making cheese of the Camembert type. The directions are based upon the research work which has been carried out by this Department in cooperation with the Connecticut Storrs Station during the last 3 years. Cheese of the Camembert type, considered equal in every way to the imported article, is now being manufactured at the station, the director of which announces in an introduction to the bulletin that the station is now prepared to assist factories and individuals in making this type of cheese.

Report of the congress of dairying, olive culture, and olive-oil industry, 1905 (*Cong. Leitaria, Olivicult. e Indus. Azeite 1905, Relat. Geral, I, pp. 764*).—This volume contains a number of reports relating to the dairy industry in Portugal. These deal with the raising of cows, sheep, and goats; the culture of forage crops; natural pastures; the production and sale of milk; manufacture and sale of butter, cheese, and condensed milk; construction of dairy buildings; cooperative dairy associations; agricultural credit in relation to the advancement of dairying and the olive industry; dairy schools and experiment stations; and the adulteration of milk and its products.

The microscopical examination of wine, A. BLAVIA (*Abonos Químicos, 7 (1907), No. 75, pp. 76–82, figs. 8*).—Notes are given on the microscopic examination of wines, the article being illustrated by figures showing crystals and the yeasts and other organisms commonly found.

Manufacture of vinegar from pure culture of acetic-acid bacteria, L. EBERLEIN (*Pure Products, 3 (1907), No. 4, pp. 173–177*).—The manner in which pure cultures of acetic-acid bacteria are used in vinegar making is described.

VETERINARY MEDICINE.

Report of the veterinarian, G. H. GLOVER (*Colorado Sta. Rpt. 1906, pp. 164–166*).—Particular attention has been given during the year to an investigation of loco weeds and horse typhoid. The results of these investigations will be published later. It appears that horse typhoid in Colorado is not due to parasitism with *Strongylus armatus*, but probably to infection with a blood parasite.

Regulations relating to animals' quarantine, 1907 (*Canad. Dept. Agr., Health of Animals Branch, 1907, pp. 16*).—The quarantine regulations of the Dominion of Canada are given in detail with definitions of terms used in the text and special accounts of the rules adopted for horses, mules, cattle, swine, and other animals. Orders Nos. 26–29 of the Minister of Agriculture relating to quarantine accompany the pamphlet.

Annual report of the State board of live stock commissioners of Ohio, T. L. Calvert and P. Fischer (*Ann. Rpt. Bd. Live Stock Comrs. Ohio, 5 (1906), pp. 43, figs. 13*).—The demand for the application of the tuberculin test has been greater than ever before. Considerable attention on the part of the board of commissioners has been given to sheep scab and glanders. Brief statements are given regarding the prevalence of anthrax, actinomycosis, foot rot of sheep, infectious hog diseases, nodule disease, mange in horses, and other infectious diseases. Copies are also given of laws relating to the inspection of live stock and the control of animal diseases in the State.

The incineration of animal bodies in a portable apparatus, J. C. E. Lange (*Fortschr. Vet. Hyg., 4 (1907), No. 12, pp. 265–269, figs. 3*).—A comparatively inexpensive apparatus is described and illustrated consisting of a metallic cylinder mounted on wheels with a fire box underneath. The cylinder is of sufficient size to receive animal carcasses which are incinerated by the use of wood or other convenient fuel. The apparatus makes it possible to dispose of infectious animal bodies in a simple and convenient manner.

The sporulation of anthrax bacilli, R. Eberle (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 2 (1907), No. 2–3, pp. 224–226*).—In a study of this question the author finds that gypsum sticks are well suited for use in sending material suspected of containing anthrax bacilli. Sporulation takes place readily upon the sticks of gypsum, but the process also requires the presence of oxygen and a certain moisture and temperature.

Transmission of pathogenic bacteria by the larvæ of worms, Weinberg (*Compt. Rend. Soc. Biol. [Paris], 62 (1907), No. 4, pp. 203–205*).—From the studies carried out by the author it appears that the larvæ of worms in penetrating the intestinal mucous membrane are largely freed from pathogenic organisms which may have been attached to the surface of these parasites. These organisms are surrounded and destroyed by the phagocytes of the intestinal walls. In some cases, however, parasitic worms carry pathogenic bacteria through the intestinal wall, thus introducing the bacteria into the blood system or even into the subperitoneal tissues, where the parasitic worms become encysted.

Tumors in animals, Cadiot (*Rec. Méd. Vét., 84 (1907), No. 3, pp. 87–103*).—The author discusses heredity, species, age, rations, traumatism, chronic inflammatory conditions, and infection as related to the development of cancerous tumors in various species of domestic animals.

A laboratory incubator, E. G. Hastings (*Wisconsin Sta. Rpt. 1906, pp. 116–119, fig. 1*).—On account of the expensiveness of bacteriological incubators, the author devised a simple means of installing one at a small cost. For this purpose an ordinary refrigerator was adapted to use for the bacteriological laboratory. The incubator with a regulator and heating apparatus was installed at a cost of $80.

Tuberculosis work for 1905-6, H. L. Russell and E. G. Hastings (*Wisconsin Sta. Rpt. 1906, pp. 91–99*).—The station officials have taken an active part in the detection and eradication of tuberculosis, especially among dairy cows. The tuberculin test has been applied on a large scale under an agreement that the owner shall discard for dairy purposes all reacting cattle.

A summary is presented of the results obtained by tuberculin tests since 1901. The percentage of reacting animals in these tests has varied from 2.7 to 19.7 and the number of animals annually tested from 182 to 5,781.

Tuberculosis in the light of recent literature, HEUSS (*Ztschr. Veterinärk., 19 (1907), No. 3, pp. 121–143*).—Some of the chief problems connected with the study of tuberculosis are stated and attention called to the wide variation of opinion which prevails on these points. It is believed that much study must be devoted to this disease before the controverted points will be established.

The chemical constitution of the tubercle bacillus, J. AUCLAIR and L. PARIS (*Compt. Rend. Acad. Sci. [Paris], 144 (1907), No. 5, pp. 278–281*).—The use of petroleum ether in extracting the fat from tubercle bacilli gave unsatisfactory results and the author, therefore, resorted to ether and chloroform. The experiments reported in this paper indicate that the acid resistance of the tubercle bacillus is not due exclusively to the fat or waxy material contained in the bacillus, but is a property of the body of the bacillus as a whole.

Behavior of pus cells toward tubercle bacilli, E. LÖWENSTEIN (*Ztschr. Hyg. u. Infektionskrank., 55 (1906), No. 3, pp. 429–450, pl. 1*).—It has long been observed that the leucocytes of animals affected with tuberculosis are capable of surrounding tubercle bacilli to a greater or less extent. At times, however, the leucocytes seem to lose this power. The author's observations were made on experimental animals and on pus cells obtained from the sputum of tuberculous human patients.

It appears from these experiments that the tubercle bacilli in a given tubercle acquire the power of resisting the leucocytes in that tubercle, and in general the same statement seems to be true for the tubercle bacilli present at any given time in the tuberculous animal. Such leucocytes, however, when removed from the body and mixed with material containing tubercle bacilli from some other animal show an active power in surrounding the bacilli. The author concludes, therefore, that tubercle bacilli have the power of gradually acquiring a resistance to the leucocytes with which they are more or less in constant contact.

A leather mask for use in the clinical diagnosis of bovine tuberculosis, L. OPALKA (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 2 (1907), No. 2–3, pp. 227, 228, fig. 1*).—Considerable stress is laid on the possibility of clinical diagnosis of tuberculosis. For this purpose the respiratory sounds must be studied by auscultation. In order to increase the energy of respiration the nostrils are closed for a short time, and for this purpose a leather mask has been devised.

Nonreaction of tuberculous cattle to tuberculin, J. LIGNIÈRES (*Bul. Soc. Cent. Méd. Vét., 84 (1907), No. 4, pp. 90–112*).—Detailed clinical notes and post-mortem findings are given on a number of cases of tuberculosis in cattle which did not react to tuberculin. The author believes that this tolerance of tuberculin is perhaps of more frequent occurrence than has usually been suspected, and sometimes occurs in animals which show no clinical symptoms of the disease.

Infection with tuberculosis through the urachus, E. VÁMOS (*Deut. Tierärztl. Wchnschr., 15 (1907), No. 5, pp. 63, 64*).—The evidence for transmission of tuberculosis through the essential reproductive cells is very slight, but a number of cases are known where the disease has been transmitted through the fetal membranes. Attention is called to these cases, and a detailed statement is given of a case in which infection took place in a calf through the umbilical cord.

The harmlessness of dust originating from desiccated tuberculous sputum, CADÉAC (*Jour. Méd. Vét. et Zootech., 58 (1907), Feb., pp. 65–71*).—After a series of experiments, during which animals were made to inhale or ingest

material containing tuberculous sputum, the author comes to the conclusion that such material is without virulence either for the respiratory or digestive organs. It is believed to be impossible to produce the disease by inhaling dust containing tuberculous sputum which has become desiccated without the influence of sunlight. It was shown by experiment that guinea pigs were not infected by eating 25 to 200 mg. of such material.

Tuberculosis in hogs without caseation or calcification, M. JUNACK (*Ztschr. Fleisch u. Milchhyg., 17 (1907), No. 5, pp. 164–171, figs. 2*).—In a number of instances the author had occasion to observe tuberculosis in hogs in which the disease showed no tendency toward regression or natural limitation. The tubercles did not undergo caseation or calcification. On this account the author argues that in such cases of tuberculosis the whole carcass of the affected pig should be boiled or cooked by steam before admission for use as human food.

Vaccination against tuberculosis through the alimentary tract, J. NICOLAS (*Jour. Méd. Vét. et Zootech., 58 (1907), Jan., pp. 42–45*).—This is a critical review of the experiments of Calmette, Guerin, Vallée, Roux, Arloing, and Stazzi. It has been found possible to produce an active immunity against tuberculosis by feeding animals tubercle bacilli of human origin, or bovine bacilli previously killed by heat or greatly attenuated. The immunity thus produced develops within a few months and is apparently of long duration.

Vaccination of cattle against tuberculosis, J. LIGNIÈRES (*Bul. Soc. Cent. Méd. Vét., 84 (1907), No. 4, pp. 112–125*).—A record is given of 6 animals which were vaccinated against tuberculosis.

It appears from these and other experiments that tubercle bacilli which possess their full virulence have the power of producing the highest degree of immunity. The more tubercle bacilli used for vaccination are attenuated the weaker becomes the immunity. This is true without regard to the method adopted for attenuating the bacilli. From a sanitary standpoint it would be better if animals could be vaccinated against tuberculosis by the use of tubercle bacilli which could not multiply in the vaccinated animal. Immunity produced in this manner, however, is of short duration and of little value, and it is therefore necessary to use bacilli which possess some virulence. In no case, however, should vaccine be used from which the bacilli would remain alive for a long time in the tissues of the animal.

Combating tuberculosis on sewer farms, P. VINCEY (*Rev. Hyg. et Pol. Sanit., 29 (1907), No. 2, pp. 109–113*).—The question having arisen regarding the possibility of danger to cattle from grazing on sewer farms, this matter was investigated with the result that the author discards the idea that forage grown on land irrigated with sewer water can carry tuberculosis to cattle. In case of an outbreak of the disease on such farms the usual method of procedure under other circumstances is recommended.

The etiology of milk fever, J. DE VRIES (*Tijdschr. Veeartsenijk., 34 (1907), No. 5, pp. 310–318*).—The literature of this subject is briefly reviewed for the purpose of citing cases in which milk fever has occurred without any connection with parturition. The etiology of the disease must still remain somewhat unclear since neither the theory of cerebral anemia nor that of the action of specific toxins thoroughly explains it.

Combating blackleg in Vogelsberg, A. SCHEIBEL (*Deut. Tierärztl. Wchnschr., 15 (1907), Nos. 5, pp. 61–63; 6, pp. 77–80, figs. 3*).—The investigations reported in this paper were carried out on cattle and sheep. During a period of 5 years in which 3,200 cattle were vaccinated, only 3 were lost and the cause of death in these cases was not definitely determined. For the benefit of local practitioners, the author recommends that portions of the muscle tissue be saved from animals which die of blackleg in order to prepare vaccine from this

material. In vaccinating sheep, excellent results were obtained whether the vaccine was introduced in the tail or thigh.

An epizootic form of pneumonia caused by a new pasteurella in sucking calves, J. Lignières (*Bul. Soc. Cent. Méd. Vét., 84 (1907), No. 2, pp. 45–51*).—A peculiar form of pneumonia prevailed among a herd of calves in Argentina. The disease appeared suddenly with a high fever and rapid respiration. The temperature usually rose above 40° C. and the majority of affected animals died. The lesions were largely confined to the thoracic cavity, which was filled with a reddish fluid. The pericardium and pleura were somewhat infiltrated and the lungs extensively hepatized. A peculiar form of pasteurella was isolated from these cases and attempts were made to treat some of the affected animals with a polyvalent serum. The results were encouraging in mild cases, but only one serious case was cured by this method.

Treatment of gid in cattle, Probst (*Wchnschr. Tierheilk. u. Viehzucht, 51 (1907), No. 8, pp. 141–143*).—In ordinary cases there is considerable difficulty in locating the gid worm on the surface of the brain by the clinical symptoms of the infected animal. A description is given of a crude method adopted by an empiric, during which the position of the worm was determined by the sound obtained by tapping the forehead with a hammer. The skull was then trepanned and the gid worm removed. The animal recovered within a reasonable time.

Acute mastitis with fatal results following foot-and-mouth disease, G. P. Moretti (*Clin. Vet.* [*Milan*], *30 (1907), No. 10, pp. 145–147*).—Notes are given on the clinical symptoms in two cases of acute mastitis which appeared during the course of foot-and-mouth disease. Injections of a 5 per cent solution of creolin were made in the udder and caffein was also administered without much beneficial effect.

Sheep scab and enzootic ophthalmia, F. W. Garnett (*Vet. Rec., 19 (1907), No. 973, p. 554*).—Carbolic dip had been used in double strength on a herd of sheep infected with scab. When the author examined this herd of sheep a number of cases of ophthalmia were observed, which were at first supposed to be due to the irritating effect of the dip. This was found, however, not to be the case, from which it appears that troubles of this sort may sometimes wrongly be attributed to the action of the dip.

Creosote as a remedy for parasitic gastritis in sheep, H. Taylor (*Vet. Rec., 19 (1907), No. 970, p. 492*).—A flock of sheep became badly infested with *Strongylus contortus* and the author tested the value of creosote in combating these parasitic worms. A 1 per cent solution of coal-tar creosote in water was prepared and each sheep was given 4 oz. of this solution. Previous to the use of the creosote the sheep had been dying at frequent intervals from the effects of the stomach worm, but after drenching with creosote no deaths occurred during a period of 12 months, after which the history of the sheep was not followed.

Saccharomycosis in the nostrils resembling glanders, G. Marcone (*Rev. Gén. Méd. Vét., 9 (1907), No. 101, pp. 249–253*).—An opportunity was had to study lesions produced by *Saccharomyces equi* in the horses belonging to a regiment of artillery. Symptoms developed which closely resembled those of glanders, including a nasal discharge, swelling of the submaxillary glands, and ulcerations of the skin. A microscopic examination of the nasal discharge, however, at once disclosed the nature of the disease.

A report on pneumonia in army horses, Ludewig (*Ztschr. Veterinärk., 19 (1907), No. 2, pp. 49–66*).—Extended observations showed that the majority of horses which recover from this disease are thereafter immune. Notes are given

on the prevalence of pneumonia and the regulations which have been adopted for controlling the disease, including quarantine and compulsory infection.

Pernicious anemia of the horse, H. CARRÉ and H. VALLÉE (*Rev. Gén. Méd. Vét., 8 (1906), No. 95, pp. 593–608, figs. 4; 9 (1907), No. 99, pp. 113–124, figs. 4*).—According to the authors' experience, acute cases of this disease are absolutely incurable. In some instances improvement is noted as a result of high feeding and the use of tonics, but such improvement is more apparent than real. Immunization has not proved successful by the means thus far adopted, but further experiments along this line will be carried out. The disease is transmitted through the digestive tract and the excretions of diseased animals are virulent for some time. This suggests a practical means of checking the prevalence of the disease.

Equine malaria, F. A. VERNEY (*Natal Agr. Jour. and Min. Rec., 10 (1907), No. 1, pp. 1–5*).—The post-mortem changes produced by this disease are briefly described. It may be cured in a large percentage of cases if Epsom salts, niter, and quinin are given in large quantities at the outset. Equine malaria is probably carried by ticks, although this has not been definitely established.

Swamp fever in horses, L. VAN ES (*North Dakota Sta. Rpt. 1906, pt. 1, pp. 48–65, pls. 6*).—For a number of years a form of anemia has been observed in horses in Minnesota, the Dakotas, and Manitoba, and has usually been referred to as swamp fever. It has caused considerable losses in infected localities. Recently a disease appeared among horses in the Red River Valley and appeared to be identical with swamp fever. A careful study was made of this disease from the clinical symptoms and autopsies, and the observations made along this line are compared with those recorded from studies of the disease in other localities. The work thus far carried on has not led to a definite conclusion regarding the etiology of the disease. The symptoms and pathological lesions are fairly constant and a variety of parasites and bacterial organisms were found in affected animals. None of these, however, has been shown to be the cause of the disease.

The treatment of dourine, V. L. YAKIMOV (*Arch. Vet. Nauk [St. Petersb.], 36 (1906), No. 12, pp. 945–986*).—A series of experiments was carried on with mice, guinea pigs, rabbits, and dogs during which trypanrot was used to test its value in the treatment of experimental dourine.

It is found that trypanrot shows a specific action in the treatment of dourine. Doses of 0.5 cc. of a 1 per cent solution are capable of causing the trypanosomes to disappear from the blood of mice if introduced within 5 days after the animal has been inoculated. This treatment, however, does not prevent an occasional relapse. Trypanrot was found to possess a very limited prophylactic value, but when used within from 5 to 9 days after inoculation it will prevent fatal results. In guinea pigs it exercises a toxic effect. When administered in hypodermic injections in the proper strength of solution, trypanrot causes no bad effect in white mice or gray rats, but in guinea pigs, rabbits, and dogs it produces an inflammation of the adjoining tissue.

A little recognized cause of colic in the horse, H. MOLLEREAU (*Rev. Gén. Méd. Vét., 9 (1907), No. 101, pp. 241–249*).—The causes commonly recognized for colic in the horse are usually operative in cases of this disease. The author, however, had opportunity to study an outbreak of colic among cavalry horses which received water contaminated from sewage and carrying typhoid bacilli. When these organisms were present in large numbers, digestive disturbances were observed in the horses, under a form which could scarcely be distinguished from colic. In the author's opinion more attention should be given to the quality of water which horses receive.

Further experiments on the filterability of the virus of swine plague and hog cholera, R. OSTERTAG and A. STADIE (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 2 (1907), No. 2–3, pp. 113–147*).—Six inoculation experiments were carried out with filtered virus obtained from hogs affected with swine plague. It was found that the disease could not be transmitted in this way. With hog cholera, however, results were different. In 5 out of 8 cases the disease was transmitted by the use of filtered virus. The authors conclude, therefore, that Schweinepest of Germany, like hog cholera in this country, is caused by a filterable virus and that *Bacillus suipestifer* becomes subsequently established in the lesions.

The Swedish regulations regarding infectious swine diseases, A. PETERSSEN (*Veröffentl. K. Gsndhtsamt., 31 (1907), No. 10, pp. 231–237*).—Copies are given of the most recent proclamations of the Swedish government regarding measures for the control of hog cholera, swine plague, and swine erysipelas.

The etiology of rabies, P. REMLINGER (*Compt. Rend. Soc. Biol. [Paris], 62 (1907), No. 6, pp. 249, 250*).—On the basis of his experience the author maintains that in more than 50 per cent of cases rabies virus introduced into animals or human beings will make its way along the nerves or through tissues and produce the usual symptoms of rabies.

Diagnosis of rabies in laboratories, LENTZ (*Fortschr. Vet. Hyg., 4 (1907), No. 12, pp. 269–275*).—In the author's experience the identification of Negri's corpuscles furnishes a reliable and satisfactory means of diagnosing cases of rabies. As a rule, rabbits inoculated with virulent virus show symptoms of the disease within from 13 to 21 days. This inoculation test may be resorted to in cases where diagnosis by Negri's corpuscles is impossible.

Negri's corpuscles in fixed virus, B. V. FURSENKO (*Arch. Vet. Nauk [St. Petersb.], 36 (1906), No. 10, pp. 735–739*).—As a result of the microscopic study of Negri's corpuscles, the author comes to the conclusion that complete evidence regarding the etiological significance of these bodies can not be developed until improved methods are devised for the study of their structure.

Immunization against fowl cholera, hemorrhagic septicemia, and swine plague with bacterial extracts, J. CITRON and R. PÜTZ (*Ztschr. Hyg. u. Infektionskrank., 56 (1907), No. 1, pp. 145–174, pl. 1*).—The bacterial extracts with which the experiments reported in this paper were carried on are identical with the artificial aggressins of Wassermann. In the preliminary experiments it was found that rabbits could be thoroughly immunized against fowl cholera by the use of bacterial extracts obtained from serum. These results are attributed to artificial rather than to natural aggressins. Immunization is more easily accomplished in rabbits than in pigeons. By means of artificial aggressins similar satisfactory results were obtained in the case of hemorrhagic septicemia and swine plague. It is held, however, that while the organisms of these three kinds of septicemia behave in a very similar manner this fact can not be used as proof of their identity.

The virus of fowl plague, V. K. RUSS (*Arch. Hyg., 59 (1906), No. 4, pp. 286–312*).—The blood from cases of this disease is exceedingly virulent, being fatal when used in such extreme dilution as 1 : 1,000,000,000. The microorganism of the disease appears to be in some way attached to the blood corpuscles or in some cases to wander into these structures. In a centrifugal machine, the virus of fowl plague may be partly separated from the blood corpuscles and serum, although no complete sterilization of any part of the material can be accomplished in this way. Notes are given on the effect of various chemicals upon the virus of the disease.

An attempt was made to produce active immunity by the use of the virus

killed by high temperature. The experiments along this line fail to give satisfactory results and indicate that immunity can not be brought about by the method in question.

Fowl plague, C. DEPPERICH (*Fortschr. Vet. Hyg., 4 (1907), No. 10, pp. 217–226; 11, pp. 244–250*).—A number of experiments were made in artificial inoculation with this disease. The literature of this subject is critically reviewed and notes are given on the commonly observed pathology. It has been impossible thus far to demonstrate the micro-organism of the disease, but all experiments indicate that it is ultra-microscopic in size.

The use of diphtheria antitoxin in the treatment of roup, BATTIER (*Compt. Rend. Soc. Biol. [Paris], 61 (1906), No. 37, pp. 605, 606*).—In an outbreak of roup among fowls the author tested diphtheria antitoxin such as is used in human cases of this disease. The results were very satisfactory in all cases. The dose used was 1 cc. The author was able by this means not only to check the spread of the disease, but to bring about a cure in affected birds. These experiments raise again the question regarding the possible relationship between roup and human diphtheria.

RURAL ENGINEERING.

Small reservoirs in Wyoming, Montana, and South Dakota, F. C. HERRMANN (*U. S. Dept. Agr., Office Expt. Stas. Bul. 179, pp. 100, pls. 8, figs. 13*).—A large area of the arid land in the Western States can only be reclaimed by comparatively small irrigation plants erected by settlers with limited means and making use of the small torrential streams, which are dry a greater part of the year. These small systems must include reservoirs of capacity sufficiently large to accumulate as much as possible of the flood flow of the stream and in many instances their proper construction requires greater engineering skill and attention than can be given by the settlers or county surveyor. Many small reservoirs are now planned or under construction to fulfill the requirements of the Desert Land Act and the settlers undertaking these constructions are in need of professional advice which their restricted means and the remoteness of the work prevent their securing. The author has therefore undertaken to provide a manual for such settlers, and in critically discussing existing reservoirs and the problems connected with reservoir construction offers many suggestions which should be helpful to them.

A large number of small reservoirs in northeastern Wyoming, western South Dakota, and southeastern Montana were personally visited by the writer, and each reservoir is discussed from the standpoint of construction and cost, defects where existing being pointed out, and the profits accruing through the use of stored water being given where data could be secured. The most obvious defect in the reservoirs visited was a lack of ample wasteway capacity, and in the light of this fact the author develops a method of computing the size of wasteway based upon the intensities of storms likely to be found on the watersheds of the reservoirs in the section considered.

From records of the Weather Bureau diagrams are drawn showing the intensities of storms of different lengths and the run-off for a factor of 25 per cent, although it is stated that "with the catchment area well saturated it varies from about 18 per cent for the 2-hour storms to about 30 per cent for 5-minute storms, though this variation is not uniform." From this data a concrete case is cited and the necessary capacity of the wasteway is determined, the example illustrating the great importance of the effect of short but severe storms which frequently occur in the locality under discussion.

The design and construction of dams and wasteways suitable for small reser-

voirs is taken up in some detail, the form, material, and methods of construction being considered. From his investigations the author concludes that while in the district in question cattle and stock raising must remain the chief industry, yet the system of continuous ranging must eventually be abandoned and the range supplemented by the farm, which will be irrigated by the flood waters of small streams conserved in reservoirs. The annual outlay in farming 60 acres, including the interest on the reservoir and irrigation plant and the cost of cultivation of the land, is placed at $470, while from the products grown upon this area it should be possible to maintain during the winter 1,200 head of sheep, which should bring in an annual return of $900, leaving a net profit of $430 from winter feeding.

Evaporation losses in irrigation and water requirements of crops, S. FORTIER (*U. S. Dept. Agr., Office Expt. Stas. Bul. 177, pp. 64, pls. 2, figs. 19*).—This bulletin reports the results of investigations which have been carried on for a number of years by this Office in cooperation with the State of California to determine not only the evaporation losses in irrigation, but also the remedies which will lessen these losses. Experiments were conducted in water-jacketed tanks under field conditions in the following localities: Tulare, Pomona, Berkeley, Chico, and Riverside. Evaporation losses were determined by weighing the tanks, various methods of application of the water and various systems of cultivation and mulching being studied. From these experiments it was found that the conditions having greatest influence on evaporation from soils are the quantity of water in the top soil, the temperature of the soil and water, and the wind movement. The application of water at a depth of 3 in. or more was found to subject it to a much reduced soil temperature and thereby lessened evaporation, while cultivation after irrigation has the same effect, since loose earth is a poor conductor of heat. Reduction of the temperature of the water was found to be equally productive of economy, a reduction of 7° in temperature, decreasing evaporation from a water surface by 0.1 in. per day, which points to the possibilities of saving by applying water at night when the surface soil is cool, or by applying it at sufficient depths to keep it from coming in contact with the hot surface layer of soil.

The experiments which have a direct bearing on present irrigation practice are those testing the effects of cultivation after irrigation and applying water in furrows of different depths. The saving in a 6-day period by cultivation in one case was 6.25 per cent of water applied and in another experiment, where less water was applied, the saving in a 3-day period was 2.38 per cent of the water applied. The maximum saving shown by the furrow experiments was 9.23 per cent of the amount applied, the experiments covering 10 days.

Another point forcibly brought out by the experiments is the large loss when water is applied in frequent light irrigations, which keep the water always exposed to the conditions causing the largest evaporation.

In the experiments on water requirements of crops, it was found that for conditions similar to those at Tulare 18 to 24 in. is the best amount of water to use in the irrigation of wheat, while barley was found to have about the same water requirements. Horse beans grown at Berkeley were found to give crops increasing with the amount applied up to the maximum used of 38 in.

Arterial drainage in Ireland (*Engineer [London], 103 (1907), No. 2677, p. 394*).—A commission appointed in 1905 to inquire into matters bearing on the arterial drainage of Ireland has recently issued its report, which comprises various points of general interest.

After reviewing the several drainage acts which have been passed from time to time and which have largely become inoperative, due to the unsettled condition of land tenure and unequal or impossible distribution of benefits,

the commissioners are of the opinion that it is essential to repeal all existing drainage acts and to pass a new one suited to existing conditions. It is proposed that this act shall provide "for the initiation, execution, and maintenance of new districts as well as for the maintenance of existing ones." It contemplates bringing into harmonious working a drainage department, the county councils and the rural councils, as well as the individuals to be directly benefited. The organization is so designed, since many small districts could be drained and improved at small cost without much engineering difficulty and the assents of the proprietors could be easily obtained, while the increased value of the land would repay the outlay. On the other hand, there are large works presenting serious engineering difficulties and involving heavy expenditure. Where such works are to be undertaken an excess of the actual over the estimated cost must be contemplated, and the difficulty of securing the assents of the proprietors to the scheme would be correspondingly increased. The security for the repayment of the loan would also have to be considered. Finally the large works, such as the improvement of the outfalls of large rivers, being admittedly of unproductive nature, but absolutely essential, would, if done at all, have to be assisted by the State by means of free grants.

The commission recommends that in many instances outfall works should be designed to meet the ordinary annual floods instead of providing works capable of taking care of exceptional floods which occur at intervals of perhaps 20 years, and thereby saving considerable in the first cost.

The report describes the constitution and powers of the proposed administrative bodies and deals with the financial considerations involved. It is recommended that government loans for arterial drainage should be made direct to the county councils, the councils recovering the due proportion of the annual installment from each landholder by means of the "poor rate." Further, the commissioners are of the opinion that it would be injudicious as well as unjust to levy a pro ratum assessment on the entire catchment basin for the purpose of drainage, but that the cost should be borne by the land actually drained and improved.

Portable hog houses, J. G. Fuller (*Wisconsin Sta. Rpt. 1906, pp. 42–46, figs. 2*).—Describes method of construction and gives material necessary for a small portable cot costing complete about $12.50.

Farm implement investigation, C. A. Ocock (*Wisconsin Sta. Rpt. 1906, pp. 285–287*).—Gives information in tabular form as to the number of farm machines used by the Wisconsin farmer and an idea of the care given these machines.

RURAL ECONOMICS.

Cyclopedia of American agriculture. Farms, L. H. Bailey et al. (*New York: The Macmillan Co., 1907, vol. 1, pp. XVIII+618, pls. 25, figs. 756*).—This volume is the first of a contemplated series of four volumes and is a popular survey of agricultural conditions, practices, and ideals in the United States and Canada. It consists of four parts dealing, respectively, with the agricultural regions, the projecting of a farm, the soil environment, and the atmospheric environment. On these topics a great storehouse of available information is presented.

Report of the Irish Agricultural Organization Society, Limited, N. T. Everard and R. A. Anderson. (*Rpt. Irish Agr. Organ. Soc., 1906, pp. 136*).—Detailed statistical data and discussions of the work of the affiliated organizations for the year ended June 30, 1906. There was a net gain over the preceding year of 60 societies, of which 32 were credit societies or cooperative banks and 18 agricultural societies for the purchase of farm supplies.

Agricultural credit, F. Fasquelle (*Semaine Agr. [Paris], 26 (1907), No. 1354, pp. 133, 134*).—The author discusses the relation of local agricultural credit banks to the district banks, the organization of credit banks, how farmers are admitted to membership and secure loans, the rates of interest paid on loans, and other matters relating to the organization and administration of agricultural credit banks in France.

Agricultural settlements (*Bol. Sec. Fomento [Mexico], 6 (1907), No. 7, pp. 244–255*).—This article reviews the methods of establishing and directing small agricultural holdings in the neighborhood of cities and in industrial centers of France, Germany, England, Belgium, and Sweden for the purpose of providing work for the city unemployed and of interesting industrial workers in agricultural pursuits. The beneficial results of this movement from the economic, moral, and financial points of view are especially commended.

The purpose of the article was to call attention to agrarian conditions in Chile, where the land is said to be held by a few people. As a result, hostility prevails between proprietors and workers, the rural districts are being depopulated, pauperism increases in the cities, and the most vigorous portion of the population emigrates from the country. The adoption of the European system of breaking up large estates into small holdings and the governmental encouragement of land settlement by providing land, seed, implements, fertilizers, etc., to reliable settlers under easy terms are advocated for the improvement of economic conditions in Chile.

The article is reprinted in the above publication because its teachings are said to be equally applicable to Mexico at the present time.

Agricultural cooperation, R. Paisant (*Semaine Agr. [Paris], 26 (1907), No. 1354, pp. 132, 133*).—A discussion of the law of December 29, 1906, regulating the control of the 40,000,000 francs set aside by the French government for the aid of agricultural cooperation, with special reference to the disposition of the fund, methods of securing loans, and the importance of the movement to French agriculture.

The international cooperative movement in agriculture, M. Paisant (*Bul. Soc. Nat. Agr. France, 67 (1907), No. 2, pp. 168–176*).—The author discusses the tendency of the movement in agricultural cooperation to pass beyond national boundaries, and briefly outlines the history to date of several international organizations whose aim it is to make world-wide the prosperity of agriculture.

The competitive ability of large, medium, and small size farming, J. Hoch (*Landw. Jahrb., 36 (1907), No. 1, pp. 1–97*).—A detailed critical discussion of this subject in which it is shown in general that small and medium-size operations are economically superior to farming on a large scale. This advantage, however, is due not so much to the district in which the farm lies nor to special methods of culture as to the greater productivity of a uniform soil and of the industry as a whole.

Agricultural bank act amendments (*Jour. Dept. Agr. West. Aust., 15 (1907), No. 2, pp. 124–126*).—The expansion of the agricultural industry in Western Australia from 73,408 acres under cultivation in 1890 to 364,704 acres in 1906 is attributed in great measure to the establishment of the agricultural bank system.

Under the law and its amendments which went into effect on February 1, 1907, £1,000,000 is now made available to borrowers on farm property at 5 per cent interest. The conditions under which sums may be borrowed and repaid, as well as the care of the property, are enumerated. For the first five years interest only is collected, but at the expiration of that time regular installments of principal and interest become payable semiannually for 25 years, or sooner at

the option of the borrower. The improvement of holdings under the present law as a means of affording employment to persons out of work in commercial centers is urged upon the agricultural property holders of Western Australia.

Report of the departmental committee on small holdings in Great Britain, Earl of Onslow et al. (*London: Govt., 1906, pts. 1, pp. III + 61; 2, pp. VIII + 542*).—Part 1 contains the report of the committee with recommendations, and part 2 the minutes of evidence and 27 appendixes relating to agricultural holdings in Great Britain and other countries. The recommendations of the committee have been noted from another source (E. S. R., 18, p. 885).

Agriculture in Japan, E. Théry (*Écon. Européen, 31 (1907), No. 793, pp. 359–361*).—This is a discussion of the present condition of agriculture in Japan, the improvement that has taken place since 1895, and the interest taken by the government in promoting agriculture by means of experiment stations, agricultural credit banks, and cooperative societies.

Statistics are given relating to the production and exportation of camphor and lacquer, the number of cattle, horses, sheep, goats, and pigs, the extent of the fish and silk industries, and the use of commercial fertilizers. More than 60 per cent of the population of Japan are engaged in agricultural pursuits, and in 1900 3,338,600 were engaged in the fish industry. A large quantity of fish is used as fertilizer, but latterly large importations of commercial fertilizers from the United States, Chile, and England are being utilized. The value of these imports in 1905 was 57,195,552 francs. The wages of farm help have increased 70 per cent since 1895.

Agricultural production in Japan, R. Gonnard (*Rev. Écon. Internat., 2 (1907), No. 1, pp. 136–162*).—An article similar in scope to the above, but with more detailed discussion of the extent of cultivated and uncultivated land, forests, food and industrial products, stock raising, fishing and fish culture, and particularly the extent of recent legislation in behalf of agriculture in Japan.

Twenty-second statistical report of the department of agriculture and commerce, Japan, B. Kuré (*Statis. Rpt. Dept. Agr. and Com. Japan, 22 [1906], pp. XII + 644, maps 3*).—Detailed statistical data on the production, exportation, and importation of agricultural products for the year 1906, together with other statistics on the commerce, industries, fisheries, mining, forests, etc., of Japan.

Crop Reporter (*U. S. Dept. Agr., Bur. Statis. Crop Reporter, 9 (1907), No. 5, pp. 33–40*).—Statistics and notes on the condition of crops and the supplies, value, and prices of agricultural products in the United States and foreign countries are summarized.

The ninth biennial report of the commissioner of agriculture, State of Florida, B. E. McLin (*Bien. Rpt. Comr. Agr. Fla., 9 (1905–6), pp. VII + 647*).—This report for the years 1905 and 1906 contains detailed agricultural statistics for 1904 and 1905, commercial statistics for 1905 and 1906, meteorological data for 1905, reports of the fertilizer and stock feed, prison, and land departments, general statistics from the State census of 1905, and a report by the chemist for 1905 and 1906.

Annual statistical and crop report of Louisiana for the year 1906, C. Schuler (*Ann. Statis. and Crop Rpt. La., 1906, pp. 12*).—The acreage, yields, and value of the principal farm crops are summarized, with data on the agricultural and other industries of the State. A special article by W. Newell gives the results of nursery inspection in Louisiana since 1905.

Annual statistical report of the New York Produce Exchange for the year 1906, with comparisons with preceding years (*Ann. Statis. Rpt. N. Y. Produce Ex., 1906, pp. 147*).—Tabulated statistical data on the production, shipments, and prices of staple agricultural products in the United States.

Agricultural statistics [of Argentina] for 1906 (*Estad. Agr. [Argentina], 1906, pp. 59, fig. 1*).—Tabulated data relating to the acreage under crops, the production, exportation, importation, and prices of farm products, including live stock and meat, for the year 1906 in comparison with preceding years are reported.

Agricultural and live stock statistics for the year ending March 31, 1906, with prefatory report, L. H. SHOLL (*Agr. and Live Stock Statis. So. Aust., 1906, pp. XXIII + 91*).—Detailed statistical data of land occupation, acreage and yields of crops, number of live stock, etc. The prefatory report discusses these statistics in comparison with similar data for preceding years to show the progress made in the agricultural industry of South Australia during the past decade. The methods of securing the data as strictly confidential government property are also explained.

Agricultural statistics, Ireland, 1906 (*Dept. Agr. and Tech. Instr. Ireland, Agr. Statis. 1906, pp. 41*).—The data are more detailed and in revision of those previously noted (E. S. R., 18, p. 788).

Summary of agricultural statistics for the years 1901 to 1905 (*Bul. Agr. [Brussels], 22 (1906), No. 7, pp. 999–1055*).—Tabulated data for each province of Belgium of the acreage and yields of crops, the utilization of commercial fertilizers and feeding stuffs, the number of live stock, and the number and size of farm holdings. The farms increased from 277,754 in 1901 to 296,314 in 1905, with 1,707,696 and 1,761,757 hectares under cultivation, respectively.

AGRICULTURAL EDUCATION.

Agricultural education in England, J. C. MEDD (*Nineteenth Cent. and After, 1907, No. 359, pp. 108–118*).—This is a critical discussion of the shortcomings of agricultural education in England, the causes of which are attributed mainly to lack of system and central direction.

Agricultural instruction of collegiate grade is said to be fairly well provided for, but the great shortcoming is the "scanty provision of facilities for intermediate agricultural education of a systematic character," such as would "provide for the sons of small farmers from 13 or 14 to 16 or 17 years of age." Schools similar to the higher elementary schools in France and winter schools of agriculture and horticulture similar to those in Holland are recommended.

The writer believes that the term "agricultural" should not be applied to instruction in the public schools owing to the general misunderstanding which arises and the discredit into which the subject consequently falls. He would apply the term "rural science" or "nature study" to this class of teaching. He demands for the country boy as thorough an elementary education as the town boy has, and recommends a differentiation between rural and village schools not by means of any fundamental change in their respective curricula, but by the different treatment of the subjects and "their orientation toward the immediate and varying surroundings of each school."

The fundamentals of farming, C. D. SMITH (*Country Gent., 71 (1906), Nos. 2807, p. 1061; 2808, pp. 1085, 1086; 2809, p. 1109; 2810, pp. 1133, 1134; 2811, p. 1157; 2812, p. 1181; 2813, p. 1205; 72 (1907), Nos. 2814, pp. 5, 6; 2815, p. 29; 2816, pp. 53, 54*).—The titles of these papers are as follows: (1) The vacant space in soils, (2) the structure of the soils, (3) water as a solvent, (4) the movement of water in soils, (5) preventing losses of soil water, (6) the formation of humus, (7) water and air in soils, (8) soil temperatures—chemistry, (9) getting nitrogen into the soil, and (10) nitrogen and other elements.

The growing importance of plant physiology in agricultural education, C. E. Bessey (*Lincoln, Nebr.: 1906, pp. 5*).—An address before the Society for the Promotion of Agricultural Science, in which the evolution of botany teaching is traced and the importance of a thorough knowledge of plant physiology to the plant pathologist, the plant breeder, and the scientific agronomist is emphasized.

The farm mechanics laboratory in higher agricultural schools, A. Lonay (*Ann. Gembloux, 17 (1907), No. 2, pp. 95–98*).—An argument for the establishment of farm mechanics laboratories in the higher agricultural institutions of learning.

Foreign schools of home economics and their creation in France, L. Henry (*Bul. Mens. Off. Renseig. Agr. [Paris], 6 (1907), Nos. 1, pp. 42–65; 2, pp. 173–191; 3, pp. 323–345*).—This is a report to the Minister of Agriculture by Professor Henry of the National School of Horticulture at Versailles, who in preparation for this work visited many of the schools and colleges for women in Belgium, Switzerland, and other countries.

The first part of the report is taken up with a discussion of the necessity for special instruction for farmers' daughters, in which it is pointed out that in this respect France compares very unfavorably with Belgium, Germany, Austria, England, and North America.

A project for the organization of instruction in agriculture and domestic economy for the daughters of farmers is outlined. The establishment of three types of schools is recommended: (1) Complementary and professional agricultural schools, (2) schools of agricultural home economics, and (3) temporary and movable schools of agricultural home economics.

The first type of school corresponds somewhat nearly to the practical schools of agriculture for boys in France except that the studies are to be of higher grade and less varied. They are to be elementary finishing schools for farmers' daughters, with a regular course of study covering 2 years and a supplementary elective course of 1 year. The subjects to be included in the course of study are pedagogy, French, arithmetic, farm accounts, history, geography, the natural and physical sciences, drawing, and hygiene. The natural sciences will include botany, geology, mineralogy, and zoology, but special attention will be given to domestic economy, horticulture, dairying, poultry culture, and animal husbandry. The report outlines in considerable detail the proposed course of study and the organization and equipment of the schools. This type of school is considered the most important and the one to be most generally established.

The proposed schools of agricultural home economics correspond to the farm schools for boys in France. There are already 3 such schools, 2 known as dairy schools, and 1 as a school of agricultural home economics and dairying.

The third type of school is the temporary or movable school of agricultural home economics, corresponding somewhat closely to the winter schools of agriculture in Germany. It is suggested that after these 3 types of schools are established it would be well to inaugurate one or two superior schools of agricultural home economics corresponding to the national schools of agriculture for young men.

After outlining at some length his project for instruction in home economics in France, the writer describes the various schools and other agencies for the education of young women along lines of agriculture and home economics in Belgium, the Grand Duchy of Luxembourg, Alsace-Lorraine, and Switzerland. He also gives a list of schools for young women in Germany not mentioned in his description.

The established principles of nature study, M. A. Bigelow (*Nature-Study Rev., 3 (1907), No. 1, pp. 1–7*).—The writer contends that there is now general agreement among authorities and leading teachers concerning (1) the working definition of nature study, (2) its differentiation from science in the strict sense, (3) the aims of nature study for elementary education, (4) the fundamental nature of the observational method, (5) the principle governing selection of materials for nature study, and (6) the dependence of nature study on child study.

Nature study is defined as "the simple observational study of common natural objects and processes for the sake of personal acquaintance with the things which appeal to human interest directly," and the author proceeds to harmonize this definition with the views of Professors Hodge and Bailey on this subject. Contrasting nature study with elementary science, the writer takes the position that the former is for the sake of personal acquaintance with the things which appeal to human interest directly and independently of their relations to organized science, while the latter is the "close analytical and synthetical study of natural objects and processes primarily for the sake of obtaining knowledge of the general principles which constitute the foundations of modern science." Nature study should lead up to and into the study of science.

The values of nature study are said to be in discipline and information. The aims are to give general acquaintance with and interest in common objects and processes in nature, to give first training in accurate observing, and to give pupils useful knowledge concerning natural objects and processes as they directly affect human life and interests. Concerning the "dependence of nature study on child study," the writer contends that we must recognize the fact that there is a difference between nature study for children and nature study for adult minds.

Suggestions for conducting community gardens, Susan B. Sipe (*Atlantic Ed. Jour., 2 (1907), No. 9, pp. 22–24, figs. 5*).—These are suggestions based on the experience of the writer in conducting children's gardens in Washington, D. C., and include answers to many troublesome little problems that have hitherto confronted the teacher of school gardening, such, for example, as the size of plats, the nature of the preliminary instruction, the plan of the gardens, and the correlation of gardening with other subjects and its adaptation to country school conditions.

Course in fruit growing for movable schools of agriculture, S. B. Green (*U. S. Dept. Agr., Office Expt. Stas. Bul. 178, pp. 100*).—This is the second in the series of bulletins for movable schools of agriculture. It includes general suggestions to teachers and a syllabus of 15 lectures, each of which is supplemented by suggestions for experiment and practice work. The lectures cover general discussions on the factors that make up a good fruit-growing section, cultivation and cover crops, the use of fertilizers, varieties, planting, pruning, orchard protection, harvesting, marketing, storing, botany of cultivated fruit plants, propagation of fruit plants, and specific cultural directions for the apple, pear, quince, peach, nectarine, plum, apricot, cherry, grape, and several small fruits. Lists of references, apparatus, and material are appended.

Organization lists of the agricultural colleges and experiment stations in the United States (*U. S. Dept. Agr., Office Expt. Stas. Bul. 176, pp. 100*).

University of Tennessee. Relations of the University to the State (*Univ. Tenn. Rec., 10 (1907), No. 2, pp. 65*).—This is a report by a special committee of the board of trustees of the University of Tennessee appointed to inquire into the exact relationship under its charter of the University of Tennessee to

the State. The report goes back to the origin of Blount College in 1794. This institution was subsequently turned over to East Tennessee College, later known as East Tennessee University, and after 1879 as the University of Tennessee.

The social rôle of the farmer's wife, P. DE VUYST (*Le Rôle Social de la Fermiere. Brussels: Librairie Albert Dewit, 1907, pp. 184*).—This is a valuable compilation of information concerning the professional training of farmers' wives and some of the agencies concerned in this work, including domestic science associations, reading circles, women's institutes, and definitely organized courses of instruction in schools in Germany, Austria, Luxembourg, France, Russia, Scandinavia, Switzerland, the United States, and Canada.

MISCELLANEOUS.

Annual Reports of the Department of Agriculture, 1906 (*U. S. Dept. Agr. Rpts. 1906, pp. 698*).—This is made up of the reports of the Secretary and heads of Bureaus. The various reports are also issued as separates.

Nineteenth Annual Report of Colorado Station, 1906 (*Colorado Sta. Rpt. 1906, pp. 109–170*).—This contains the organization list, a report of the director, departmental reports, and a financial statement for the fiscal year ended June 30, 1906.

Fifteenth Annual Report of Delaware Station, 1903 (*Delaware Sta. Rpt. 1903, pp. 172*).—This contains a financial statement for the fiscal year ended June 30, 1903, and reports of the heads of departments containing numerous articles which are abstracted elsewhere in this issue.

Annual Report of Idaho Station, 1906 (*Idaho Sta. Rpt. 1906, pp. 40*).—This contains the financial statement for the fiscal year ended June 30, 1906, a report of the director, and departmental reports one of which is abstracted elsewhere in this issue.

Twentieth Annual Report of Nebraska Station, 1906 (*Nebraska Sta. Rpt. 1906, pp. 16*).—This contains the organization list, a review of the work of the station during the year, and a financial statement for the fiscal year ended June 30, 1906.

Seventeenth Annual Report of North Dakota Station, 1906 (*North Dakota Sta. Rpt. 1906, pt. 1, pp. 90*).—This contains the organization list, titles of the station bulletins issued during the year, a brief report of the director, departmental reports containing articles abstracted elsewhere, and a financial statement for the fiscal year ended June 30, 1906.

Annual Report of Porto Rico Station, 1906 (*Porto Rico Sta. Rpt. 1906, pp. 32*).—This report contains a summary of investigations conducted at the station during the year and separate reports by the horticulturist, entomologist and plant pathologist, and coffee expert. These are abstracted elsewhere in this issue.

Twenty-third Annual Report of Wisconsin Station, 1906 (*Wisconsin Sta. Rpt. 1906, pp. 321*).—This includes the organization list of the station, a report of the director on station work during the year, a list of bulletins issued by the station from 1883–1906, numerous articles abstracted elsewhere in this issue, the text of the State fertilizer and feeding-stuff laws with lists of the brands licensed, lists of exchanges and donations, and a financial statement for the fiscal year ended June 30, 1906.

Experiment Station Work, XL (*U. S. Dept. Agr., Farmers' Bul. 281, pp. 32, dgm. 1*).—This number contains articles on the following subjects: Insolu-

ble phosphates; forms and methods of applying lime; sediment in irrigation water; hardy Bermuda grass; Williamson method of corn culture; killing sassafras sprouts; soluble oils for San José scale; corn as food for man; storing preserves and canned goods; incubation of chickens; prevention of nodule disease of lambs, and some milk terms.

List of publications of the agricultural experiment stations in the United States (*U. S. Dept. Agr., Office Expt. Stas. Bul. 180, pp. 104*).—This gives the number, title, and author of each of the publications of the experiment stations from the time of their organization to June 30, 1906. The Office files of station publications from which this list has been prepared contain over 7,600 reports and bulletins.

Accessions to the Department Library, July-December, 1906 (*U. S. Dept. Agr., Library Buls. 61, pp. 61; 62, pp. 56*).

NOTES.

Alabama College and Station.—W. T. Clarke, entomologist, has resigned. The college announces the establishment of a 3-year degree course in veterinary medicine and surgery and of a chair of animal industry. D. T. Gray, formerly assistant in animal industry, has been appointed to the latter position and will divide his time between college and station work. A. J. Norman, a graduate of the Iowa College, has been appointed assistant in horticulture in the college and station, vice C. F. Kinman, who has resigned to accept a position with the Cuban Experiment Station. Plans are under way for the erection of a central dining hall and an infirmary.

Alabama Tuskegee Institute and Station.—P. C. Parks, farm superintendent, has resigned to assume charge of the agricultural department of Clark University at Atlanta, Ga.

Arizona Station.—E. E. Free, assistant chemist, has resigned and will be succeeded by W. H. Ross, of the University of Chicago. The vacancy in the horticultural department occasioned by the resignation of V. A. Clark, previously noted, has been filled by the appointment of J. E. Coit, of Cornell University.

California University and Station.—A dairy building, stock pavilion, and two cottages are being erected on the new farm at Davisville. Short courses will be opened there in the fall. Considerable experimental work is being planned.

Florida University and Station.—E. H. Sellards, professor of zoology and geology in the university and geologist in the station, has resigned to become State geologist.

Iowa College.—The cornerstone of the new four-story agricultural building was laid June 6 by Gov. A. B. Cummins, and the first story is now well under way. As planned, the building will have a frontage of 234 feet and a depth of 78 feet, besides an assembly-room wing with a frontage of 92 feet and a depth of 69 feet. Fireproof construction is to be used throughout, with granite base and Bedford stone walls, and the total cost with equipment will be about $350,000. Arrangements have been made for the completion of the equipment on the poultry and dairy farm. The area of the college farm and grounds has been increased by recent purchases to a total of about 1,200 acres.

Maine University and Station.—Hon. S. W. Gould, of Skowhegan, has been appointed a member of the committee of the trustees on the experiment station, in the place of Hon. A. J. Durgin. L. H. Merrill, chemist to the station, has also been appointed professor of biological chemistry in the university. R. C. Gellerson, a recent graduate of the university, has been appointed inspector under the laws regulating the sale of feeding stuffs, seeds, fertilizers, foods, and drugs. W. M. Munson, for more than fifteen years horticulturist of the station, has resigned to accept a similar position at the West Virginia Station, where special emphasis will be given to plant breeding in its relation to pomology.

Massachusetts College and Station.—The Carnegie Foundation for the Advancement of Teaching has tendered a pension to Dr. C. A. Goessmann, and his retirement is announced. Doctor Goessmann has been professor of chem-

istry at the college practically since its establishment and chemist to the State board of agriculture since 1873. In 1882, upon the establishment of the State Experiment Station, he became its director and chemist, remaining in this capacity until its union with the Hatch Experiment Station. Since that time he has been chemist to the station, and a year ago was made honorary director. He will continue to act as consulting chemist to the station. C. Wellington, associate professor of chemistry, has been appointed professor of chemistry in the college.

The chemical work of the station has been united and amplified into a department of plant and animal chemistry, under the direction of J. B. Lindsey, of the division of foods and feeding, as chemist. E. B. Holland, as associate chemist, will have charge of a research division, H. D. Haskins of the fertilizer control work, and P. H. Smith of the feed and dairy division. R. D. MacLaurin, Ph. D., at present of the Rockefeller Institute, has been engaged as a chemist in the research division. G. H. Chapman, a recent graduate of the college, has been appointed assistant in the department of botany and plant pathology in the station, vice N. F. Monahan, resigned. P. A. Russell, of Great Barrington, has been appointed to the board of trustees.

In the college the department of horticulture has been reorganized as a division of horticulture, to include at present departments of pomology, landscape gardening, and floriculture. F. A. Waugh is the head of the new division, with the title of professor of general horticulture and professor of landscape gardening, and E. A. White will continue in charge of the work in floriculture. F. C. Sears, professor of horticulture in Nova Scotia Agricultural College, has been appointed to the professorship of pomology, and F. M. Gracey, a graduate of the Massachusetts Normal Art School, has been made assistant in landscape gardening. S. B. Haskell, instructor in agriculture, has been granted a year's leave of absence for graduate work at the University of Leipsic.

Minnesota University and Station.—W. M. Liggett has resigned as dean and director on account of failing health, and has been appointed superintendent of the Grand Rapids Substation. He is succeeded by E. W. Randall, of the board of regents.

Missouri University.—John M. Evvard, a graduate of the University of Illinois, has been appointed assistant to the dean.

New Jersey Stations.—The resignation is noted of Miss J. A. Voorhees, assistant horticulturist.

New York State Station.—Appointments have been made as follows: J. G. Grossenbacher as assistant botanist, M. J. Dorsey as assistant horticulturist, and Otto McCreary and J. T. Cusick as assistant chemists.

North Carolina Stations.—The experimental work of the State board of agriculture has been organized as an experiment station, to be known as the Agricultural Experiment Station of the North Carolina State Department of Agriculture, and with the following staff: B. W. Kilgore, director, farm crops; Tait Butler, veterinarian, animal husbandry; W. N. Hutt, horticulturist; Franklin Sherman, jr., entomologist; T. B. Parker, cooperative experiments; W. M. Allen, chemist, foods; C. D. Harris, assistant chemist and microscopist, stock feeds; Miss H. M. Card, assistant chemist, foods; J. M. Pickel, W. G. Haywood, L. L. Brinkley, and S. O. Perkins, assistant chemists; G. M. MacNider, soils; L. M. Smith, assistant entomologist, and R. W. Scott, F. T. Meacham, J. H. Jefferies, and R. W. Collett, superintendents of the substations at Edgecombe, Iredell, Pender, and Transylvania, respectively. Of these, Messrs. Kilgore, Butler, Hutt, and Sherman have resigned corresponding positions in the college station, which, as previously announced, is to be maintained

under separate management. C. B. Williams, now agronomist, has been appointed director of the latter.

Ohio University and Station.—J. W. Decker, professor of dairying in the university, died June 21 of pleuro-pneumonia at his country home near Columbus. Miss Minnie A. Stoner, head of the department of domestic science, has resigned to accept the position of dean of women and professor of domestic science in Wyoming University. A cattle building, a stock judging pavilion, and a horse building are under construction at the university and will be completed this fall at a total cost of $80,000. T. F. Manns has been appointed assistant plant pathologist in the station, vice J. M. Van Hook, who has resigned to accept a position with the University of Indiana.

Virginia College and Station.—M. P. Jarnagin, J. R. Fain, and P. O. Vanatter have resigned to accept the professorships of animal husbandry and experimental agronomy and the superintendency of field demonstrations, respectively, in the Georgia College, to take effect September 1.

Washington College and Station.—The presidency of the college and directorship of the station have been separated, and R. W. Thatcher, chemist of the station, has been appointed director, to take effect September 15.

West Virginia University and Station.—John L. Sheldon has been appointed professor of bacteriology and plant pathology in the medical department of the university and is no longer connected with the station.

Wisconsin University and Station.—Mazÿck P. Ravenell, Ph. D., late assistant medical director of the Henry Phipps Institute for Tuberculosis, Philadelphia, has been elected head of the department of bacteriology in the university and station. J. L. Sammis, Ph. D., who has been connected with this Department in its cooperative cheese investigations with the station, has been elected assistant professor of dairying. E. V. McCollum, Ph. D., of Yale University, and Shinkichi K. Suzuki, a graduate of Sapporo Agricultural College, have been elected, respectively, instructor and research assistant in agricultural chemistry, and A. J. Rogers, jr., and Charles Knight, recent graduates of the college of agriculture, assistants in horticulture and in fertilizer and feeding-stuffs inspection, respectively.

Wyoming University and Station.—B. C. Buffum, professor of agriculture and horticulture in the university and director of the station, has resigned to engage in commercial work. J. D. Towar, formerly of the Michigan College and Station, and more recently principal of the Roseworthy Agricultural College in South Australia, has been appointed director and entered upon his duties July 1. J. A. Hill, a recent graduate in the agricultural course, has been appointed wool expert in the station and placed in charge of its wool investigations under the Adams fund. R. E. Hyslop, instructor in agronomy in the university and agronomist in the station, has resigned.

Association of Official Agricultural Chemists.—The twenty-fourth annual convention will be held October 9–12 at Norfolk, Va., under the auspices of the Jamestown Exposition.

International Congress of Agriculture.—The Eighth International Congress of Agriculture was held at Vienna May 21–26, with over 2,000 delegates and visitors in attendance. The congress was opened by Prince Carl Auersperg. Senator and Ex-Minister of Agriculture Jules Méline, of France, delivered the opening address on The Return to Mother Earth, in which he made a strong plea for agriculture and rural life, in both its economic and social phases. In his opinion a very marked tendency is now manifested in most countries to give to the tillers of the soil a higher social position. An indication of this was evidenced in the placing of the palatial parliament building at the disposal of

the congress for its meetings, a privilege never before accorded to representatives of agriculture. For the transaction of business the congress was organized into eleven sections, among which were those on rural economics, agricultural education, farm machinery, crops and plant industry, brewing, and irrigation and drainage.

Papers on the organization and function of the experiment stations were submitted by Dr. F. W. Dafert, of Vienna, Dr. Thomas Kosutány, director of the Hungarian experiment station at Budapest, and Dr. A. C. True, of this Office. In these papers the chief function of the stations was declared to be investigation in agriculture, and the necessity of relieving the chief officers of essentially all work of instruction and of control work involved in the execution of the laws relating to agriculture was emphasized. Resolutions embodying these conclusions were adopted by the section.

As in previous years, special attention was given by the congress to a discussion of farm mechanics. The desirability and importance of establishing international rules for the testing of farm machines were pointed out, although it was admitted that in the testing of tools used for the cultivation of the soil, the soil conditions made the establishment of definite conditions for such tests practically impossible. Attention was called to the importance of instruction in the use of farm machines in agricultural schools, including practical work in the construction and repair of implements and actual field tests.

During the congress trips were made to the local experiment station, the agricultural high school, and other points of interest. The utmost hospitality was shown by the citizens and officials of Vienna, receptions being tendered by the mayor, Emperor Francis Joseph, and others.

Korean Experiment Station.—An agricultural and model station was recently established by the Japanese government, at an expense of $85,000, at Suwon, Korea. The station was formally opened on May 15, and turned over to the Korean government. Under the direction of Japanese experts the following lines of work are to be undertaken: The increase of the productivity of the land throughout the country by securing a better geographical distribution of the different kinds of produce according to climate and soil, the improvement of the quality of agricultural seeds, the introduction and acclimatization of new varieties of farm products, the supplying of farmers with good manures, irrigation, drainage, and protection against inundations, the utilization of waste lands, the improvement of poultry and dairy farming, sericulture, and the growing of by-products on the farm.

New Forestry School.—A school of forestry, offering a four-year course leading to the degree of bachelor of science in forestry, will be established at the University of Washington at the beginning of the next college year. Instruction in this subject has been given at the university since 1895. The university campus comprises 355 acres of land adapted under the climatic conditions of Puget Sound to the growing of a wide variety of forest trees. The university also owns large tracts of land in various sections of the State, on which extensive experiments may be conducted.

New Botanical Journal.—The International Association of Botanists has established a new journal, *Progressus rei Botanicæ*, under the editorship of its secretary, Dr. J. P. Lotsy, of Leiden. Its initial number consists of articles on The Ontogeny of the Cell since 1875, by E. Strasburger; The Present Position of Palæozoic Botany, by Dr. H. D. Scott; Bibliography of Literature on Palæozoic Fossil Plants, by E. A. Newell Arber; and The Progress of Botanical Geography since 1884, by C. Flahault.

Necrology.—The *Journal d'Agriculture Pratique* announces the death of Louis Gustave Heuzé, in Paris on April 18, in his ninety-first year. Heuzé, as professor of agriculture, had been connected at different times with various institutions in France, and for more than fifty years had been one of the editors of the *Journal d'Agriculture Pratique*. He was a voluminous writer, particularly on agricultural topics. Among his best-known works are Les Plantes Céréales, Les Plantes Fourragères, Les Pâturages, Les Prairies Naturelles et les Hersages, Les Plantes Industrielles, and Les Plantes Légumières Cultivées en Plein Champ, many of which have been issued in numerous editions.

Sir Dietrich Brandis, the "father of systematic forest management in the British Empire," died at Bonn, March 28, in his eighty-third year. His work was done largely in India, where he developed the present extensive forest system and organized at Dehra the first forestry school, now the Imperial Indian Forest School. Through the training of a large number of forestry experts, he also had a great share in the development of forest conservation in this country. His chief publication is Indian Trees, which appeared in 1906.

Dr. Alexander Buchan, the eminent Scotch meteorologist and secretary of the Scottish Meteorological Society since 1860, died May 13, at the age of 78. Among his publications were the Handy Book of Meteorology, in 1867, an Introductory Text-Book of Meteorology, in 1871, and many maps and charts.

The death is noted of Sir Benjamin Baker, the distinguished English engineer, whose name is associated with many great irrigation works of Egypt.

Alfred Newton, ornithologist and professor of zoology and comparative anatomy in the University of Cambridge for many years, died June 7.

Dr. Maxwell T. Masters, for many years editor of *The Gardeners' Chronicle*, died May 30, at the age of 74. He was a prolific writer on horticultural and forest botany, and his work on Vegetable Teratology, first published in 1869, remains a standard work.

Miscellaneous.—According to *Breeders' Gazette*, A. E. Parr, Ph. D. (Leipsic), a graduate of the University of Edinburgh, and who recently received the degree of M. S. A. from Iowa State College for work in animal husbandry, has been appointed director of agriculture and animal husbandry of British India and will have charge of the 39 experiment stations of that country. It is stated that the salary attached to the position is $10,000 a year for ten years, followed by a pension of $5,000 a year for life.

At the recent session of the Texas legislature a law was passed requiring the teaching of agriculture in the public schools of the State.

According to *Science*, Dr. John Brittain, professor of chemistry at New Brunswick University, has been appointed to the chair of nature study at the MacDonald Agricultural College.

T. B. Wood has been appointed Drapers' professor of agriculture in the University of Cambridge, to succeed T. H. Middleton, whose resignation has been previously noted.

Dr. A. W. Harris, formerly director of this Office, was installed as president of Northwestern University, June 20.

Dr. Otto Folin, research chemist at the McLean Hospital for the Insane, has been appointed associate professor of biological chemistry at the Harvard Medical School.

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EXPERIMENT STATION RECORD.

CONTENTS OF VOL. XVIII, NO. 12.

SUBJECT LIST OF ABSTRACTS.

AGRICULTURAL CHEMISTRY.

METEOROLOGY—WATER.

SOILS—FERTILIZERS.

FIELD CROPS.

HORTICULTURE.

FORESTRY.

LIST OF EXPERIMENT STATION AND DEPARTMENT PUBLICATIONS REVIEWED.

Stations in the United States.

U. S. Department of Agriculture.

NOTE.—The publications of the United States Department of Agriculture, except those of the Weather Bureau, may be purchased from the Superintendent of Documents, Washington, D. C. For the publications of the Weather Bureau requests and remittances should be directed to the Chief of the Bureau. The price of the Record is $1 per volume, or 10 cents per number. The prices of other technical publications are given in the list above. The publications of the State experiment stations are distributed from the stations and not from the Department.

EXPERIMENT STATION RECORD.

VOL. XVIII. AUGUST, 1907. No. 12.

Dr. Charles A. Goessmann, of Massachusetts, who retired from active service with the close of the college year, has long been one of the most conspicuous figures in agricultural chemistry in this country. For nearly forty years he has been an active member of the faculty of the Massachusetts Agricultural College, his service covering almost the entire period since the college was established. One of the earliest pioneers in agricultural investigation, his work has been not only a contribution to knowledge, but an inspiration to others and a potent influence for the development of agricultural experimentation. It has exhibited unusual versatility and breadth of knowledge, and has been characterized by a thoroughness and conservatism which have given great reliability to his conclusions. The celebration of his eightieth birthday just before commencement and his retirement as emeritus professor and under a pension from the Carnegie Institution close an active career full of honor to himself and of service to his fellow-men.

Doctor Goessmann was educated at the University of Göttingen, Germany, receiving his doctorate in 1853. While there he became the favorite student and later the assistant of the eminent chemist Wöhler, from whom he received his inspiration to follow chemistry rather than pharmacy, which had been his original choice. His investigations in the Göttingen laboratory were of a fundamental character and covered a wide range of organic compounds. The results were embodied in something over twenty papers published in *Annalen der Chemie und Pharmacie*. Many of these related to the constituents of plant and animal products, such as peanut oil, in which he discovered two new fatty acids, cocoa oil, strychnin, leucin (a product of pancreatic digestion of proteids), hippuric acid, and others; and as early as 1857 he reported upon "a new sugar plant, *Sorghum saccharatum*."

In that year he accepted from a former American fellow-student the position of scientific director of an extensive sugar refinery in Philadelphia. Following this he studied the sugar industry in Cuba and the West Indies and in 1861 became chemist of the Onondaga

Salt Works, at Syracuse, N. Y. There he remained until 1869, making in the meantime important contributions upon the chemistry of brines and reporting upon the salt deposits in Canada and Louisiana. A portion of each year was spent at Rensselaer Polytechnic Institute as professor of physics and chemistry. He resigned from this position early in 1869 to accept the professorship of chemistry in the Massachusetts Agricultural College, at the instance of his old friend and classmate at Göttingen, President W. S. Clark of the college.

His familiarity with the methods of agricultural instruction in Germany and his high educational standards made him an influential factor in shaping the courses of the young institution. Industrious and resourceful to a degree, he made the most of inadequate accommodations and equipment and introduced the laboratory method of instruction in his department. This, together with the attention which he gave to the practical applications of chemistry in agriculture and the industries, served to make his courses both instructive and practical. His students soon came into demand for industrial positions, and his laboratories were for many years a training ground for agricultural and technical chemists, who have been called to important positions in every part of the country. As a teacher, it was his advanced students especially who came to know him as a scholar, and who received from him inspiration and encouragement for further study, which has led an unusual number of them to go abroad for that purpose.

Almost immediately after going to the college Doctor Goessmann took hold of the agricultural problems of the State, both practical and scientific, and made them the subject of investigation. At that time agricultural investigation had made but little headway in this country. He was a pioneer in every sense of the word, and he brought to his studies a broad training in science, full confidence in its ability to reveal the laws upon which agriculture depends, and the true scientific spirit which seeks only the truth. In 1873 he was appointed chemist to the State board of agriculture, and then began a series of reports and lectures which has continued almost to the present time. He investigated the fertilizer industry of the State, at that time in a most unsatisfactory condition, outlined changes in the existing law, and established an efficient system of official control, the first of its kind in any State.

He early introduced the valuation system, which enabled farmers to intelligently interpret the results of analysis, established confidence in the value of agricultural analysis, and dispelled the illusions of the day as to special mysterious qualities of fertilizer mixtures not represented by their analysis. His reports were replete with information upon the condition of the fertilizer trade, the sources of fertilizing materials, the manurial requirements of crops, the use of

refuse and local supplies, the home mixing of fertilizers, and similar matters, which made them especially valuable at that stage. His conscientious work in this line gave him a prominent position among the fertilizer inspectors of the country, and when the latter organized the Association of Official Agricultural Chemists, in 1880, he was elected its first president.

Doctor Goessmann's studies in agricultural chemistry prior to the establishment of the experiment station covered a wide range of subjects and attracted much attention the country over. They served to confirm the popular expectation that the agricultural college would render aid to the farmer and to agriculture in general, as well as furnish an education to his sons. To him more than to any other man was due the reputation of the college as an institution for investigation in agriculture, and such was the high character of his work that it received the commendation of men of science and caused many honors to fall upon him. His previous interest in sugar production led him to make extensive experiments in the manufacture of sugar from sorghum and later from the sugar beet. His conclusions as to the practical value of sorghum as a source of sugar, although not accepted at the time, have been fully borne out by subsequent experience. His work upon the sugar beet was epoch-making and was a practical demonstration of the feasibility of beet-sugar production in the United States. It was the starting point of the more recent studies and propaganda in that line.

Doctor Goessmann early began the advocacy of an experiment station at the college, illustrating by his studies the practical value of such an institution to the agriculture of the State. A station was established in 1878 with private contributions, and while studies were prosecuted with the proceeds of the fertilizer inspection it was not until 1883 that the State made definite provision for a station. He was then appointed director and remained at its head until it was merged with the Hatch Station of the college, in 1895. Since that time he has been chemist and has had charge of the fertilizer inspection. Under his direction the station became an efficient aid to the farmer and to the agriculture of the State, and was from the first one of the leading institutions of its kind in the country.

The occasion of Doctor Goessmann's retirement was made one of honor to the man who has served the college, the State, and the cause of agriculture so long and effectively, and for expression of the affectionate regard in which he is held by his former students. At special exercises following the alumni banquet at commencement, addresses of appreciation and of congratulation were made, and he was presented with a handsome stained-glass tablet, appropriately inscribed and decorated, as a tribute from the alumni of the college. His has been a notable career, and has witnessed vast changes in the

attitude toward agricultural education and experimentation, and in the condition of agricultural science. To few men has it been given to contribute a greater or more important part in this development, and in the evening of life he may well contemplate these changes with a sense of gratification at the progress made and of satisfaction at the part he has played.

The distinguished French scientist, Jean Dumas, declared more than half a century ago that one of the most important lessons for the farmer to learn is how to produce good barnyard manure and to use it rationally; that the fundamental agricultural question is and will remain the manure question. Investigations since Dumas's time have but tended to confirm his views, recent investigators on the subject especially serving to bring the matter into prominence and to throw a new light upon the function and efficiency of such manure in the soil. It has long been understood, of course, that the fertilizing value of manure was not determined entirely nor possibly mainly by its content of nitrogen, phosphoric acid, and potash, but by its physical action and other indirect effects not very clearly defined or understood.

Modern investigation, which has placed constantly increasing emphasis on biological processes in relation to soil fertility, is making it quite clear that manure is one of the most powerful agents commonly available on the farm for promoting or controlling these processes.

The soil bacteriological studies which have so rapidly multiplied in recent years have shown that manure and similar organic materials, when properly prepared, not only furnish a readily available supply of the carbonaceous food required for the active growth of soil organisms, but may be made to furnish an easy practical means of inoculating the soil with beneficial organisms, thus indirectly increasing their productiveness.

These bacteriological studies are beginning to show how the injurious effects (denitrification, etc.), which have been ascribed to the use of manure may be obviated by proper preparation and use of this material. For example, Julius Stoklasa, director of the chemical-physiological experiment station of Prague, has recently worked out a very conclusive bacteriological explanation of the advantage of the practice, which is now generally recommended by the best authorities on the subject, of applying small quantities of manure at frequent intervals instead of making large applications at longer intervals. He shows that the frequent small applications keep the soil supplied with a sufficient and constant supply of the carbonaceous food required by the beneficial organisms, without bringing about the condi-

tions favoring the predominance of injurious organisms which would result from larger applications at any one time.

It has thus been shown to be possible by the proper handling of manure to promote the activity of the micro-organisms which (1) fix atmospheric nitrogen, (2) transform nitrogenous organic matter into more available compounds, and (3) act directly by the carbon dioxid they produce on the insoluble phosphates and potash compounds of the soil to render them available for the use of the higher plants, without at the same time incurring any serious risk of loss by denitrification or other injurious processes.

When we reflect that the above statements indicate only a few of the many ways revealed by recent investigations in which soil fertility is affected by bacteriological processes, we can readily believe that further research in this most promising field will render necessary a radical revision of many of the commonly accepted notions of soil fertility and help to put many features of present methods of fertilizing and soil management on a more rational basis.

Recent discoveries in soil bacteriology give a peculiar significance to Berthelot's dictum that the soil is a living thing (*la terre est quelque chose de vivant*) and furnish one of the many evidences of the keen insight of that eminent scientist. It was this keen scientific discernment, says Lipman, "that largely contributed to a better appreciation of soil bacteriological activities as a factor in plant production. His experiments dealing in the main with specific bacteriological processes, just as the work of Schloesing and Müntz, Warington, and Winogradski, of Dehérain and Maquenne, of Gayon and Dupetit, or of Hellriegel and Wilfarth dealt with specific processes, furnished none the less a strong argument for a more systematic study of soil bacteria in general, and led gradually to the recognition of bacteriological methods as a valuable aid in the study of soil problems. Henceforth the soil chemist, soil physicist, and soil bacteriologist, working in harmony, must each do his share in the solution of these problems."

Development in the field of soil bacteriological investigations has not been as rapid, nor has the subject received as wide attention, in this country as abroad. This is true despite the widespread activity in soil studies and fertilizing problems. This Department and a few of the experiment stations have made important contributions to this subject, particularly in the field of fixation of nitrogen by micro-organisms in symbiosis with leguminous plants. The study of soil bacteriology in its broader aspects, however, has been limited to the work of a comparatively small number of investigators in this country. These phases include the fixation of nitrogen, both symbiotic and nonsymbiotic, nitrification and other biological processes

of transforming nitrogen compounds in the soil, the rôle of microorganisms in rendering available the mineral constituents of plant food in the soil, and a number of other processes having an intimate bearing upon soil fertility and productiveness.

"Soil bacteriological research," says Lipman, "offers splendid opportunities for the collection of facts of utmost moment, not alone to the theory of agricultural science, but also to its practice. It is safe to assert that systematic investigation in this field will reward us richly in a broader knowledge of plant-food production and plant-food assimilation. It will enable us to gauge with far greater certainty the various phases of soil fertility and to make better provision for the economic utilization of the plant food derived from soil sources or from the manures and fertilizers applied."

Realizing the importance of this subject and the widely scattered condition of the literature relating to it, the Office has in course of preparation for early publication a review of investigations in soil bacteriology, prepared by Doctor Lipman of the New Jersey Station. It is hoped that this summary will serve to call attention to the progress already made, to indicate the possibilities of the subject, and to stimulate further and broader inquiry in that field in this country.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

A revision of the atomic weight of potassium, T. W. RICHARDS, A. STAEHLER, and E. MUELLER (*Jour. Amer. Chem. Soc., 29 (1907), No. 5, pp. 623–656*).—Determinations based upon the analysis of potassium chlorid and bromid are reported. These agree in showing that the atomic weight of potassium is 39.114.

A new method of determining the alkalinity of ashes, K. FARNSTEINER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), pp. 305–338; abs. in Analyst, 32 (1907), No. 374, p. 181*).—In the method proposed the ash is dissolved in a known volume of standard acid, phosphates are precipitated by the addition of calcium chlorid and a known quantity of ammonia, and the excess of ammonia is then titrated back. The results obtained by this method are usually much lower than those yielded by direct titration.

Methods of examining milk and milk products, C. BARTHEL (*Die Methoden zur Untersuchung von Milch und Molkereiprodukten. Leipsic: M. Heinsius, 1907, pp. VII+271, figs. 59; abs. in Rev. Gén. Lait, 6 (1907), No. 8, pp. 185–187*).—This is a complete treatise on the analysis of milk and its products. The chapters deal successively with the examination of milk, butter, cheese, milk products, and the decomposition products of milk, butter, and cheese.

On the methods of determining fat in milk, M. BEAU (*Lait et Indus. Ferme [Paris], 17 (1907), No. 8, pp. 57–60*).—The relative values of the practical and more technical laboratory methods of determining fat in milk are discussed. Preference is expressed for the Röse-Gottlieb method.

Tests of the salt method, K. JAROSS (*Milchw. Zentbl., 3 (1907), No. 5, pp. 185–199*).—The Gerber salt or alkali method for determining milk fat was compared with the Gerber acid method and also with the Gottlieb method and the data so obtained are used as a basis for a discussion of the various advantages and disadvantages of the salt method.

Notes on the determination of total solids in milk and on formulas used in milk control, P. GOBERT and M. BOUIN (*Rev. Gén. Lait, 6 (1907), Nos. 9, pp. 193–200; 10, pp. 224–230*).—The various methods of determining or of calculating by means of formulas the solids in milk are discussed, emphasis being laid upon the importance for purposes of milk inspection of determining the fat free extract or the ratio of fat to total solids.

The detection of cocoanut oil in butter, E. HINKS (*Analyst, 32 (1907), No. 374, pp. 160–162*).—The method described depends upon the formation of needle-shaped crystals by cocoanut oil. It is as follows: The melted and filtered fat is dissolved in ether and the solution cooled. The solid glycerids separate out in about one-half hour, leaving a clear ethereal solution which is filtered and

evaporated. The residual fat is dissolved in boiling alcohol. After cooling for 15 minutes at 5° C. the alcoholic layer is filtered and cooled to 0° C., when the characteristic crystals are deposited and identified by a magnification of 250 to 300 times.

Detection of cocoanut oil in butter, W. LUDWIG and H. HAUPT (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 10, pp. 605–610*).—Studies of the refraction and color reactions of the different fatty acids in butter and cocoanut oil are reported. The addition of cocoanut oil to butter, according to the results obtained, lowers the index of refraction and favors the formation of a red color with anilin and furfurol.

On the practical importance of the reducing power of milk, E. BRAND (*München. Med. Wchnschr., 54 (1907), No. 17, pp. 821–823*).—Schardinger's reaction is considered an important means of judging the quality of milk. The method, as given by the author, is as follows: To 10 cc. of milk at a temperature of 68 to 70° C. is added 0.5 cc. of a reagent composed of formalin 5 cc., saturated alcoholic solution of methylene blue 5 cc., and water 190 cc. The methylene blue should be entirely reduced within 6 minutes. A second sample boiled for a short period and then treated with this reagent should not be decolorized.

The fractional distillation of coal-tar creosote, A. L. DEAN and E. BATEMAN (*U. S. Dept. Agr., Forest Serv. Circ. 80, pp. 31, figs. 17*).—This circular gives preliminary results of a study of the influence of the vessel on the fractional distillation of creosote, the influence of the rate of creosote distillations, the temperatures for taking fractions, and the sources of error in creosote fractionation.

Report of the division of chemistry, B. L. HARTWELL, M. STEEL, and J. P. GRAY (*Rhode Island Sta. Rpt. 1906, pp. 181–185*).—A brief account of the work of this department of the station during 1906 is given, with analyses of miscellaneous materials, including ground limestone, hydrated lime, limekiln ashes, guano, basic slag, acid phosphate, muriate of potash, sulphate of potash, potassium carbonate, nitrate of soda, sulphate of ammonia, dried blood, acidulated fish, tankage, bone, corn meal, and mixed feed.

Annual reports on the progress of chemistry for 1906 (*London: Gurney & Jackson, 1907, pp. IX+387*).—This is the third volume of this series of reviews of progress in chemistry issued by the London Chemical Society. As heretofore, it includes reports on general and physical chemistry by A. Findlay, inorganic chemistry by P. P. Bedson, organic chemistry by H. J. H. Fenton, J. B. Cohen, and J. T. Hewitt, stereochemistry by W. J. Pope, analytical chemistry by A. C. Chapman, physiological chemistry by W. D. Halliburton, agricultural chemistry and vegetable physiology by J. A. Voelcker, mineralogical chemistry by A. Hutchinson, and radioactivity by F. Soddy.

The section on agricultural chemistry and vegetable physiology (pp. 256–293) reviews progress during 1906 in investigations relating to fixation of the nitrogen of the air in the form of calcium nitrate and calcium cyanamid, and the agricultural utilization of these products; the fixation of nitrogen by micro-organisms in the soil; the assimilation of nitrogen by plants directly and through their root tubercles; nitrification, denitrification, and decomposition of nitrogenous matter in the soil; nitrogen in rain water; green manuring and humus of the soil; optimum ratio of lime to magnesia in soils; conditions influencing the availability of phosphates in soils; the assimilation of potash and soda by plants; the utilization of the rarer constituents (manganese, copper, aluminum, mercury, silver, iodin, and fluorin) by plants; methods of studying the availability of soil constituents; the influence of sterilization and oxidation upon the availability of soil constituents; and germination, assimilation, development, micro-

organisms, enzyms, glucosids, cyanogenesis, foods and feeding, crops, strength in wheat, quality in barley, sugar, tea, tobacco, cinchona, cassava, eggs, and milk.

It is stated that the most notable progress made during the year was in investigations relating to the utilization of the nitrogen of the air by artificial means and by micro-organisms, although considerable progress was made in investigations relating to green manuring, strength in wheat, and the sugar industry. In the reviewer's opinion, the utilization of the nitrogen of the air by artificial means now resolves itself simply into a question of cost, and on this point nothing is at present definitely known.

The numerous experiments which have been made indicate quite clearly that the calcium nitrate, or lime niter, is in general as efficient as sodium nitrate as a fertilizer, and sometimes produces better results, particularly on soil needing lime. Calcium cyanamid, or lime nitrogen, has been found under favorable conditions and on soils not rich in humus or deficient in lime to be nearly as efficient as ammonium sulphate or sodium nitrate for most crops. It seems, however, not to be well suited for top-dressing or mixing with other fertilizing materials and undergoes deterioration in storage.

The reports of investigations on which the review is based have been noted from time to time.

METEOROLOGY—WATER.

Monthly Weather Review (*Mo. Weather Rev., 35 (1907), Nos. 1, pp. 1–50, figs. 3, charts 10; 2, pp. 51–102, figs. 5, charts 9*).—In addition to the usual reports on forecasts, warnings, weather and crop conditions, meteorological tables and charts for the months of January and February, 1907, monthly review of the progress of climatology throughout the world, recent papers bearing on meteorology, recent additions to the Weather Bureau library, etc., these numbers contain the following articles and notes:

No. 1.—The Kingston Earthquake, by C. F. Marvin; The Geodetic Institute at Potsdam; Permanence of Climatic Conditions; The Adirondack Rainfall Summit (illus.), by R. E. Horton; The Climate of Kansas (see below); Waterspouts in Maryland, by W. L. Mayo; Weather Bureau Men as Educators; The Climate of Yukon Territory, by R. F. Stupart; Problems in Meteorology, by C. F. von Herrmann; Problems in Mixtures of Air and Vapor; and The Growth of Fog in Unsaturated Air (illus.), by F. W. Proctor.

No. 2.—Notes of a Meteorologist in Europe, by H. J. Cox; A Beneficent Scientific Mission; Interconversion of Centigrade and Fahrenheit Degrees; Meteorological Work at Camp Wellman, Danes Island, Spitzbergen; A Climatic Sketch of Tacoma, Wash., by E. B. Gittings, jr.; Snow Rollers at Canton, N. Y. (illus.), by M. L. Fuller; E. Scharf on the Effects of Hail on Crops; Long-range Indian Monsoon Forecasts; Long-range Seasonal Forecasts for South Africa; Wilhelm von Bezold; A Winter Waterspout (illus.), by D. Cuthbertson; International Meteorology; Rainfall and Outflow Above Bohio, in the Valley of the Chagres, by H. L. Abbot; Panama Rainfall, by E. B. Garriott; Observation of Cloud Altitudes at Nighttime; and Fog on the Newfoundland Banks, by C. T. Brodrick.

The climate of Kansas (*Mo. Weather Rev., 35 (1907), No. 1, pp. 13, 14*).—This article gives a verbatim copy of the stenographic report of the testimony of the Chief of the Weather Bureau before the Committee on Agriculture of the House of Representatives January 8, 1907, bearing on the subject of climate of Kansas, as well as a statement summarizing observations on rainfall at different points in Kansas and contiguous territory during the last 30 years.

The data are classified in 10-year periods. The averages show that the first and last 10 years were periods of fairly abundant rainfall and that the middle

10 years was a period of deficient rainfall in this region. "There is practically no difference between the rainfall of the first 10 years and the last 10 years. . . . An examination of the wind records in Kansas and Nebraska shows that the last 15 years have not been quite so windy as the 15 years previous, and this is especially true of the years 1904, 1905, and 1906. It is not safe to assume, however, that a permanent decrease in the wind velocity has taken place."

Meteorological observations (*Maine Sta. Bul. 137, pp. 299–301*).—Observations at Orono on pressure, temperature, precipitation, cloudiness, and wind movement are summarized for each month of the year. The mean yearly pressure was 29.88 in., the temperature 43.5° as compared with 42.23° for 38 years. The precipitation was 39.11 in. as compared with 43.84 in. for 38 years, and the number of cloudy days was 154. Monthly and annual summaries of precipitation at 23 places are also given.

Report of meteorologist, N. HELME (*Rhode Island Sta. Rpt. 1906, pp. 317–333*).—Observations at Kingston on temperature, precipitation, prevailing winds, and general character of the weather are given for each month of the year ended June 30, 1906. The mean temperature for that period was 48.4°, the precipitation 53.57 in., and the number of clear days 175.

The underflow of the South Platte Valley, C. S. SLICHTER and H. C. WOLFF (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 184, pp. 42, figs. 13*).—Investigations carried on mainly at Ogalalla, Nebr., but also to some extent at North Platte, "to determine what resources, if any, existed in the underflow waters of the valley and whether it was practicable to make use of such waters, if they were found to exist in suitable quantities, for purposes of irrigation," are reported.

The results indicate that there is an ample supply of ground water at an average depth of 40 to 60 ft., in the South Platte Valley, for a large number of small pumping plants located in almost any part of the bottom lands. Suggestions for the construction of such small pumping plants are given.

Water resources of the Rio Grande Valley in New Mexico and their development, W. T. LEE (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 188, pp. 59, pls. 10, figs. 2*).—Observations during the field seasons of 1904 and 1905 over an area extending along the Rio Grande from the southern boundary of New Mexico northward to Santa Fe are reported. The data reported deal with geography, geology, water supply, reservoir sites, and utilization of the water supply.

The general conclusion is reached that while the flood plain material of the low lands along the river is saturated, it does not in general allow the water to pass through freely enough for the successful use of shallow irrigation wells. Deep wells may, however, be more successfully employed. The conditions in many places are apparently favorable for the establishment of reservoirs to store the large amount of flood water which passes down the Rio Grande at certain seasons.

Stream pollution by acid-iron wastes, H. STABLER (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 186, pp. 36, pl. 1*).—The investigations at Shelby, Ohio, reported in this bulletin included "(1) the history of the pollution and the attendant litigation, (2) the effect of acid-iron liquors upon sewage purification processes, (3) the conditions along the stream, and (4) the disposal of acid-iron wastes without discharge into water-course or sewerage system." Lost acid used in pickling is the present cause of pollution, and it is suggested that "by designing the plant so that this waste may be recovered as copperas, stream pollution can be practically obviated and the economic value of the plant greatly enhanced."

Investigations on the purification of Boston sewage, C. E. A. Winslow and E. B. Phelps (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 185, pp. 163, figs. 22*).—This paper contains a history of the sewage disposal problem and reports the results of experiments made at the Sanitary Research Laboratory and Sewage Experiment Station of the Massachusetts Institute of Technology.

It is stated that actual practice in Europe, outside of England, is still largely confined to chemical treatment and irrigation. In England the tendency has been largely toward the use of rapid processes of treatment.

In the United States sewage disposal practice differs widely in different localities. In New England intermittent filtration through sand has been largely used and found very satisfactory. West of the Appalachian Mountains the newer biological processes are being rapidly introduced. In the extreme West the use of sewage for irrigation is often favored.

In the experiments in the treatment of Boston sewage very satisfactory results were obtained by the process of purification by trickling over beds of coarse material. It was found in these experiments that the sewage could be "successfully filtered through a 2-ft. bed of sand with an effective size of 0.14 mm., at a rate of 0.4 million gallons per acre per day, divided into 4 doses in the 24 hours. Such high rates should not be expected in actual practice, but it is believed that with care in construction and operation the sand filter may be efficient at higher rates than have been generally advocated. . . . Crude Boston sewage may be treated in single-contact beds of fine stone (one-half inch in diameter) at a rate of about 1.2 million gallons per acre per day." A bibliography of 110 references is given.

SOILS—FERTILIZERS.

The value of poultry manure, E. and W. Brown (*Jour. Bd. Agr.* [*London*], *13* (*1907*), *No. 12, pp. 719–727*).—Observations made at the poultry farm of University College, Reading, on the amount of manure produced by different kinds of fowls under different systems of feeding, on the composition and relative value of the manures, and on methods of caring for and using poultry manure are reported.

The results of observations on the production of manure were as follows:

Production of manure by different kinds of fowls.

Kind of fowl	Weight of fowl.		Age of fowl.	Feed.	Weight per week of manure (collected and weighed daily).	
	Lbs.	*oz.*			*Lb.*	*oz.*
Wyandotte cock	6	12	16 months	Ration of barley, wheat, and bran, with green food.	1	13
Faverolles hen	5	12	15 months	do	1	$11\frac{1}{4}$
Growing chicken	3	12	14 weeks	do	1	$2\frac{1}{2}$
Fattening bird	3	8	15 weeks	Crammed with ground oats and skim milk.	1	$13\frac{1}{4}$

Similar but less complete observations were made with ducks, geese, and turkeys. A 7-lb. duck produced 6 lbs. and $10\frac{3}{4}$ oz. of manure per week, a 17-lb. turkey 4 lbs. and $1\frac{1}{4}$ oz., and a goose 10 lbs. and 1 oz.

The following table gives analyses of the manure of fowls under the ordinary conditions of a poultry farm:

Composition of poultry manure.

Name of fowl.	Moisture.		Nitrogen.		Phosphoric acid.		Potash.	
	Fresh sample.	Air-dried sample.	Fresh sample.	Air-dried sample.	Fresh sample.	Air-dried sample.	Fresh sample.	Air-dried sample.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Birds at liberty	59.50	9.96	1.75	3.99	1.00	2.27	0.54	1.22
Birds in confinement	68.30	9.50	1.47	4.21	.71	2.04	.49	1.40
Fattening birds	70.30	15.00	2.28	6.52	.97	2.77	.55	1.57
Ducks at liberty	78.00	10.00	1.20	4.90	1.09	4.46	.39	1.60
Geese at liberty	82.60	9.10	.53	2.80	.19	.97	.34	1.80
Turkeys at liberty	74.70	8.00	1.02	3.70	.66	2.40	.47	1.70
Chickens one month old	72.80	11.00	1.71	5.56	.48	1.56	.43	1.10
Chickens three months old	77.70	11.10	.90	3.61	.35	1.44	.28	1.14

The value and use of poultry manure are discussed as follows: "Fowl excreta form a distinctly nitrogenous manure which stimulates vigorous growth of the leaves, stems, and roots of plants generally as much as a dressing of nitrate of soda or sulphate of ammonia. It contains, however, in addition to nitrogen, an appreciable amount of phosphates and potash in a rapidly available form, and on this account is a good complete manure. Its value as an all-round fertilizer for all kinds of crops can be materially enhanced by mixing it with mineral superphosphates at the rate of 1 part of the latter to 5 or 6 parts of the fresh manure.

"Such as have a demand for it in a pure state should spread it thinly on trays in a shed, so that it will dry and yet retain its elements. These trays can be built in stacks. In this form fowl manure is valuable for farmers, fruit growers, and gardeners alike. It is also used for tanning. In the fattening districts of southern England there is a demand for air-dried manure at £2 10s. to £3 [$12 to $15] per ton, which fairly represents its value, as it has usually a moderate proportion of sand or earth mixed with it. Wherever feasible it should be stored in a covered shed. When dried, the compost named above can be used at the rate of 6 or 8 cwt. per acre of cultivated or fruit land. A useful plan is also to mix 2 parts of moist poultry manure with 1 part of ordinary soil by weight. In this case alternate layers should be made of earth and manure, leaving the whole until both have dried, when it is ready for use."

The fish guano industry of Norway, MAIZIÈRES (*Engrais, 22 (1907), No. 10, pp. 229, 230*).—The present status of this industry is briefly reviewed and a list of firms engaged in the business is given.

The cultivation of vegetables and the utilization of Paris sewage, D. BOIS (*Abs. in Rev. Gén. Agron., n. ser., 2 (1907), No. 1, pp. 11–13*).—The use of sewage in the culture of various vegetables on the sewage farm of Achères is described.

The electro-chemical manufacture of fertilizers, E. F. CÔTE (*Ann. Dir. Hydraul. et Amélior. Agr., Min. Agr. [France], 1906, No. 31, pp. 181–237, figs. 7*).—This is a detailed discussion of the nature of water power and its most efficient utilization in the production of electrical energy to be applied in the manufacture of nitric acid, nitrates, cyanamid, copper salts, and other chemical products, and in the liquefaction of air and the purification of water. The article especially emphasizes the economic importance and possibilities of utilizing water power in the service of agriculture.

A new method for the preparation of lime nitrogen, F. CARLSON (*Chem. Ztg., 30 (1906), No. 101, p. 1261; abs. in Chem. Zentbl., 1907, I, No. 6, p. 429*).—In the process described calcium fluorid is substituted for the calcium chlorid used in the Polzenius method of preparing nitrogen lime. It is claimed that by this means a nonhygroscopic product is obtained which is much easier to handle and which does not undergo decomposition and loss of nitrogen on standing as is the case with the Polzenius product.

Nitrate of soda from the air, H. DANNEEL (*Umschau, 11 (1907), No. 12, pp. 225–230, figs. 6*).—The Birkeland and Eyde process is described and discussed in its economic aspects.

On the production of nitric acid from ammonia, W. OSTWALD (*Berg-u. Hüttenmänn. Rundschau, 3 (1906), p. 71; abs. in Chem. Ztg., 31 (1907), No. 10, Repert. No. 8, p. 48*).—After briefly discussing different methods of artificial fixation of free nitrogen and the utilization of various materials and waste products in the manufacture of ammonia, the author describes a method which he and E. Brauer worked out in which, by the use of platinum foil and a certain amount of platinum sponge as catalyzers, 85 per cent of the theoretical amount of nitric acid was obtained from ammonia. The application of this process, using gas liquor as the raw material, in a factory at Bochum, Prussia, is described. The possibility of utilizing city refuse in the preparation of ammonia is also referred to.

The nitrate of soda industry of Chile (*Ber. Handel u. Indus., 9 (1906), No. 5, pp. 153–200*).—This is a report on the development, present condition, and outlook of this industry, by the German consul at Valparaiso.

Nitrate of soda and ammonium sulphate for cereals, KLEBERGER (*Deut. Landw. Presse, 34 (1907), No. 15, pp. 119, 120*).—Comparisons of these two fertilizers on winter rye, winter wheat, and summer oats gave results leading to the conclusion that under certain conditions, particularly on heavy soils with deep subsoils in wet seasons, it is possible to obtain larger yields with ammonium sulphate than with nitrate of soda. It is preferable to use the sulphate in one application before seeding. On spring wheat nitrate of soda is thought to have given better results than ammonium sulphate, the latter apparently delaying the ripening.

Comparative study of the different phosphatic salts contained in superphosphates, R. GUILLIN (*Bul. Soc. Agr. France, 1907, Feb. 15, pp. 188–192, fig. 1; Jour. Agr. Prat., n. ser., 13 (1907), I, No. 6, pp. 168–171, fig. 1; Bul. Soc. Nat. Agr. France, 67 (1907), No. 1, pp. 47–53*).—Comparative pot tests on wheat, buckwheat, and leguminous plants, of monocalcium, bicalcium, aluminum, and magnesium phosphates are reported. The conclusions drawn from the results are that bicalcium phosphate is as assimilable as monocalcium phosphate, that aluminum phosphate gives increases in yield comparing favorably with those obtained with calcium phosphate, and that trimagnesium phosphate is as readily assimilated by plants and produces almost the same effects as monocalcium and bicalcium phosphates.

Citric-acid-soluble phosphoric acid in Thomas slag, M. DE MOLINARI and O. LIGOT (*Bul. Agr. [Brussels], 23 (1907), No. 1, pp. 50–55, figs. 3*).—Comparative pot tests with oats and barley of normal Thomas slag and that which had been digested with 2 per cent citric acid according to Wagner's method are reported. The extracted slag was much less effective on both crops than the untreated material, and the assimilation of phosphoric acid by the plant was much smaller in the former than in the latter case.

Concerning the functions of sodium salts, H. J. WHEELER, B. L. HARTWELL, ET AL. (*Rhode Island Sta. Rpt. 1906, pp. 186–316, dgm. 1*).—The results of

experiments on this subject which have been carried on at the station since 1894 are summarized and discussed in considerable detail in this article. The completion of certain features of the work, particularly the chemical examination of the crops grown with reference to mineral constituents, was made possible by the assistance of the Bureau of Soils of this Department. The work of other investigators bearing upon the subject is reviewed. The details of the plan of the experiment and of the crop yields have been given in previous publications of the station (E. S. R., 17, p. 345).

The results of the experiment to date are summarized as follows:

"These experiments show that in the presence of very limited supplies of potassium salts, sodium salts may greatly increase the yields of certain crops.

"In the case of the mangel-wurzel, similar benefit from sodium salts occurred when as much as 332 lbs. of muriate of potash, or its equivalent of potassium carbonate, were employed per acre. Also, in connection with certain other plants similar though less marked benefit from sodium salts was observed even when the applications of potassium salt were large.

"Sodium salts were found to increase the percentage of phosphorus in the plant. In this respect the carbonate was more efficient than the chlorid. The results furnish much evidence to show that this was an incidental accompaniment of the employment of the sodium salts rather than the cause of the increased growth which resulted. This feature should nevertheless be further investigated.

"Little evidence was secured to indicate that the benefit to plant growth caused by the sodium salts was due to changing the ratio of lime and magnesia in the plants.

"The sodium salts undoubtedly acted as indirect manures by virtue of liberating potash, yet strong evidence was afforded that the potassium taken up by the plant was often more economically utilized, or, in other words, a greater crop was produced when sodium salts were applied in the manures and when relatively more sodium entered the plant.

"The water-culture investigations show unquestionable benefit, under certain conditions, from the employment of sodium salts in the presence of limited supplies of potassium, which is not attributable to liberation of plant food, effect upon soil moisture, etc. This benefit does not seem to be wholly or chiefly explainable upon the ground that the sodium salts had increased the osmotic pressure, for calcium salts failed to have the same marked effect.

"In the dry season of 1899 strong evidence was afforded that applications of sodium salts to the soil prevented the plants from taking up and removing unnecessary amounts of potash, or in other words the sodium seemed to conserve the potassium of the soil. In the wet season of 1901 the contrary apparently resulted. This indicates the necessity of a more careful study of the conditions affecting the beneficial action of sodium salts and the danger of drawing definite and final conclusions from a single experiment.

"The results do not indicate that it would be wise to purposely cut down the supplies of potassium enough to make sodium salts beneficial, for fear of depressing the crops, nor to buy common salt nor sodium carbonate for the purpose of attempting to conserve the potassium in the soil; yet the sodium in the potash salts and in nitrate of soda, which practically costs nothing, may often increase certain crops if a shortage of potassium occurs.

"The results go to show that the beneficial influence of sodium salts is largely conditioned upon the variety of plant, and this is a field of investigation that has as yet remained grossly neglected, not only in this country but also in Europe.

"It is proposed to further study the influence of sodium salts upon the reaction of the medium and the bearing of this influence upon the growth of

plants, also the possible influence of the sodium in changing the ratio of other mineral ingredients taken from solutions by growing plants. In short, it is hoped by these and other means to throw additional light upon the physiological functions of sodium and the practical significance of sodium salts in agriculture.

"A study has been begun of the influence of the application of varying proportions of sodium and potassium salts upon the organic constituents of certain plants."

Commercial fertilizers, J. S. Burd (*California Sta. Bul. 187, pp. 353–382*).—"This report gives the results of fertilizer inspection work for the first half of the fiscal year 1906–7." Analyses of 183 samples are reported and discussed. The following deficiencies occurring in 24 samples were found: In available phosphoric acid (total when available is not guaranteed) 7, total nitrogen 16, potash 9, valuation 6.

Fertilizer inspection, C. D. Woods and J. M. Bartlett (*Maine Sta. Bul. 140, pp. 63–80*).—"This bulletin contains the analyses of manufacturers' samples of brands of fertilizers licensed before February 10, 1907."

Inspection and analyses of commercial fertilizers on sale in the State, W. F. Hand et al. (*Mississippi Sta. Bul. 97, pp. 57*).—This bulletin summarizes the results of inspection of fertilizers during the season of 1905–6, reporting analyses and valuations of 437 samples, 33 of which were found to be below guarantee in relative value.

FIELD CROPS.

Report of work at McNeill Branch Station for 1905 [Field crops], E. B. Ferris (*Mississippi Sta. Bul. 94, pp. 14–29, figs. 5*).—The results of a corn fertilizer test seem to indicate that on the unimproved soils of that region the most economical fertilizer for corn is one containing 1 part of cotton-seed meal to 2 parts of acid phosphate, applied at the rate of from 100 to 300 lbs. per acre. During 4 years' work only a slight increase of crop was observed as apparently due to the use of potash salts. Among the different varieties of corn grown Cocke Prolific, for the second time, ranked first in yield with 44.6 bu. per acre. In tillage experiments, deep preparation and deep cultivation gave 36.7 bu., deep preparation and shallow cultivation 37.6 bu., shallow preparation and deep cultivation 35 bu., and shallow preparation and shallow cultivation 36.4 bu. per acre. The shallow cultivation consisted in stirring the soil about 3 in., and deep cultivation in stirring it about 5 in. deep.

The yields of different varieties of cotton ranged from 680 to 970 lbs. per acre. The leading varieties, mentioned in the order of their productiveness, were Cooks, Russell Big Boll, King No. 2, Lewis Prize, and King No. 1, all yielding 900 lbs. or more per acre. Drilling cotton in rows 3½ ft. apart gave a somewhat better yield than cotton planted in either 3 or 4 ft. rows. The average of 3 plats with the plants 9 in. apart in the drill was 1,026 lbs. of seed cotton per acre, of 3 plats with the cotton 1 ft. apart in the drill 911 lbs., of 4 plats with the plants 2 ft. apart in the drill 825 lbs., and of 4 plats with the cotton 3 ft. apart in the drill 718 lbs.

Oats sown in the fall of 1904 did not grow very tall, but were unusually heavy-headed and yielded 3,760 lbs. of well-cured hay per acre.

Spanish peanuts planted as late as June 24 produced about as well as those planted 2 months earlier. The following results were secured in a fertilizer test: No fertilizer, 1,472 lbs. of nuts per acre; 50 lbs. of nitrate of soda, 200 lbs. of acid phosphate, and 100 lbs. of kainit per acre, 1,760 lbs. of nuts; 200 lbs. of acid phosphate and 100 lbs. of kainit, 1,792 lbs. of nuts; 200 lbs. of acid phosphate, 100 lbs. of kainit, and 1,000 lbs. of air-slaked lime, 2,016 lbs. of nuts; 200 lbs. of acid phosphate, 1,760 lbs. of nuts; and 100 lbs. of kainit, 1,680 lbs. of

nuts. A measured bushel of these nuts weighed 22 lbs. One-fourth acre fertilized at the rate of 200 lbs. of acid phosphate per acre and planted to Virginia peanuts yielded at the rate of 1,792 lbs. of dried nuts and 3,520 lbs. of well-cured hay per acre, a measured bushel of the nuts weighing 20 lbs.

A fertilizer test with cowpeas was an exact repetition of the test with peanuts, and the yields of hay on the 6 different plats were 1,136 lbs., 2,872 lbs., 2,640 lbs., 2,816 lbs., 2,416 lbs., and 992 lbs. per acre, respectively. Drilling peas at the rate of 80 lbs. per acre yielded 3,520 lbs. of hay per acre, at the rate of 40 lbs. 4,000 lbs. of hay, at the rate of 20 lbs. 3,200 lbs. of hay, and peas in hills 18 in. apart, requiring 16 lbs. of seed per acre, at the rate of 4,000 lbs. of hay.

Brief notes on several other crops grown at the station are also given.

The Essex field experiments, 1906, B. W. Bull and V. H. Kirkham (*Essex Ed. Com., County Tech. Labs., Chelmsford, 1906, Apr., pp. 26, figs. 3*).—Among 7 varieties of wheat compared, Wilhelmina stood first with a yield of 49.7 bu. per acre, which was 2½ bu. ahead of Rivett. Browick produced the highest quality of straw, but in yield of straw the difference between the varieties was not very marked.

In 3 cooperative tests with mangolds an average yield of 25 tons per acre was secured. Yellow Globe ranked first in yield with 27 tons and 1½ cwt. per acre. In quality Long Red stood first, averaging 10.97 per cent dry matter and 5.13 per cent sugar. Golden Tankard was not very far behind Long Red, but Yellow Globe with 9.42 per cent dry matter and 4.25 per cent sugar was much inferior.

The yield of dry matter and sugar per acre showed the following differences at the 3 centers: Clavering, 3 tons dry matter and 1 ton 9 cwt. sugar, St. Osyth, 2 tons 12 cwt. dry matter and 1 ton 4 cwt. sugar, and Feering, 2 tons 8 cwt. dry matter and 19 cwt. sugar. The average yield at the 3 places was 2 tons 13 cwt. dry matter and 1 ton 4 cwt. sugar. The highest quality was secured on plats manured with dung only. The general effect of commercial fertilizers was to lower the quality, but the use of superphosphate seemed to favor the formation of sugar, while the dry matter followed the general rule and suffered a decrease.

Of 5 varieties of sugar beets Cooper Selected, Kleinwanzleben, and Vilmorin Improved were the best sugar producers. Vilmorin ranked highest in both tonnage of beets and purity of juice.

Fertilizer experiments with maize were conducted and the results secured showed that a supplementary dressing of nitrate was beneficial, while superphosphate and potash did not materially increase the yield. It is further concluded that leaving out barnyard manure and increasing the nitrate will not give such results in a dry season as a dressing of barnyard manure and a supplementary dressing of commercial fertilizers.

Results of a fertilizer test with peas showed that 10 tons of barnyard manure gave a return in total crop equal to that of 15 tons, and that the use of 5 cwt. of superphosphate, 5 cwt. of kainit, and 1 cwt. of nitrate of soda per acre is equal in effect to a moderate dressing of manure.

Different treatments were compared for the prevention of a clover disease caused by *Sclerotinia trifoliorum*. The plat receiving tons of ground lime per acre was free from the disease, and it is considered probable that about 10 cwt. of ground lime applied when a tilth is being obtained for the nurse crop or sown on the stubble in the fall will produce equally good effects.

Report of progress in cereal investigations, G. W. Shaw (*California Sta. Bul. 185, pp. 261–312, figs. 4*).—This bulletin describes the movement toward cereal improvement by the State, reproduces an act passed by the State legis-

lature providing for this work and appropriating money for it, together with the provisions of a cooperative agreement with this Department entered into by the station, describes the experiments which have been inaugurated, and reports the results thus far secured.

The field trials are conducted on 2 20-acre sites, 1 at Modesto, Stanislaus County, as representative of the general cereal conditions of the San Joaquin Valley, and the other at Yuba City, Sutter County, representing those of the Sacramento Valley.

In 1904–5 there were planted at Yuba City station 275 standard varieties of winter wheat, 65 standard varieties of durum wheats, 66 hybrid wheats, 65 standard varieties of barley, 12 standard varieties of oats, 2 varieties of einkorn, 2 of emmer, and 21 of corn. With the exception of corn the plantings at Modesto were almost an exact duplication of those at Yuba City. At Yuba City the spring grains made a more rapid growth than the winter grains, and were for this reason better enabled to keep the weeds somewhat in check. The character of growth of the durum wheats enabled them to cope quite successfully with the weeds. Varieties sown in March did quite well, but the heads were not so large nor so well filled as those sown the first week in January. From observations made on harvested wheat at different stages of maturity, it is considered that the grain will be of much better quality if cut as soon after ripening as possible. In rust resistance the common wheats showed a range of from 10 to 85 per cent. In all cases the commonly grown California varieties proved much more subject to rust than No. 1181, Japanese; Nos. 1433 and 1436, Crimean; No. 1558, Turkey; No. 1564, Pesterboden; No. 1698, Allora; and No. 1699, Canning Downs.

Among the 6-rowed barleys under test Beldi and Mariout, and of the 2-rowed, Black Smyrna and White Smyrna were the earliest. Sixty-day oats were the earliest oat variety, while white oats from England gave the best yield. Of the corn varieties planted at Yuba City, Early Tuscarora, Gehu, and Red Dent had nearly matured by the latter part of July. The extremely hot winds during the first week of July injured all varieties of corn which were just tasseling at that time, and none of the varieties produced good ears. It is concluded that except under the most favorable climatic conditions success in corn culture on the uplands without irrigation is very doubtful.

The operations at the 2 stations in 1905–6 are described in detail, and the plan for nursery breeding followed is outlined. The following plantings were made at the Yuba City station: 325 standard varieties of common and durum wheats, 72 U. S. Department of Agriculture hybrids, 66 Kansas hybrids, 60 of barley, 21 of oats, 1 of spelt, 3 of rye, 2 of emmer, 1 of einkorn, and 15 of corn, making a total of 566 varieties under plat tests. In addition to this work field plantings were made and special experiments relative to cereal culture, such as the use of fertilizers for wheat, rotation experiments, change of seed, and the composition of wheat as affected by time of cutting and other factors were also inaugurated. The work at the Modesto cereal station for this season was similar to that undertaken at Yuba City.

At Yuba City the durums in field plantings in most cases surpassed the common wheats, the average yield being 13.19 bu. per acre, as against 9.30 bu. for the upright-growing varieties, and surpassing the Salt Lake Club by $4\frac{1}{2}$ bu. per acre. It was also observed during this season's work that the time of cutting after the grain has reached the hard-dough stage had but little, if any, influence upon the gluten content, for in only 4 out of 8 cases did the earlier cutting show even a slightly higher percentage of albuminoids. A study made at both stations of the change toward a starchy condition seems to indicate that other fac-

tors than the time of cutting after the grain reaches the hard-dough stage are involved.

Investigations on the winterkilling of cereals, BUHLERT (*Landw. Jahrb., 35 (1906), No. 6, pp. 837–887*).—Morphological, anatomical, and chemical studies were made to determine whether the winter resistance of plants may be recognized by outer characteristics, inner structure, or chemical composition.

The morphological work was done with Johannis and Zeeland rye and Preussen and Eckendorf smooth square-head wheat. The less resistant varieties were apparently better developed than the more hardy sorts. The dry matter in the parts above ground of Eckendorf smooth square head weighed on an average per plant 0.0164 gm., as compared with 0.0150 gm. for Preussen, the hardier variety, and for Zeeland rye 0.0221 gm. as compared with 0.0176 gm. for Johannis. The average weight per plant of the dry matter in the underground parts was as follows: Eckendorf smooth square head 0.0216 gm., Preussen 0.0192 gm., Zeeland rye 0.0177 gm., and Johannis rye 0.0134 gm.

The wheat showed the greater root development and the rye the greater leaf development. It also appears that the less hardy varieties had the greater root development, the relation of above to underground substance being on an average as follows: in Eckendorf smooth square head wheat 1:1.317, in Zeeland rye 1:08, in Preussen wheat 1:1.28, and in Johannis rye 1:0.761. The root length of the less resistant varieties was also greater than in the hardy sorts, the main roots measuring 927 mm. in Eckendorf smooth square-head wheat, 873 mm. in Zeeland rye, 628 mm. in Preussen wheat, and 679 mm. in Johannis rye.

The relation between leaf surface and root length was closer in Eckendorf smooth square head and Zeeland rye than in the other 2 varieties. Measurements also indicated that the leaves of the hardy varieties were relatively longer and narrower than the leaves of the more tender sorts, and this character is believed to assist the foliage in assuming a protective position against frost and also enabling it to lie closer to the surface on uneven ground. The thickness of the leaves of the 4 varieties showed but slight differences.

The anatomical investigation showed that the plasmolytic effect of frost varied considerably between individuals and varieties and also between different species of plants. Plasmolysis as the result of frost was frequently observed in the leaves of grains, while it was not found in pine needles. The use of potassium nitrate solutions in bringing about plasmolysis also showed different degrees of resistance. Winter barley was less resistant to the action of the solution than winter rye, while pine needles were exceptionally resistant.

The chemical study of the juice of normal and frosted plants showed that the composition was about the same, but that through the action of sodium chlorid or zinc sulphate a greater precipitation of albumen was effected in the juice from normal plants. When the juice of normal plants was kept at a temperature ranging from +5° to —40° C. it was noted that chemical changes took place under the action of low temperatures, but that the juice of different plants behaved differently in this respect. The frozen juice upon melting showed a precipitate containing considerable albumen and traces of lime and phosphoric acid. This precipitate was formed in the juice of spring barley at —7°, of winter barley at —12°, and of winter rye at —15°, while the juice from pine needles was subjected to a temperature of —40° for days before precipitation was observed. It was further noted that the albumen of plants little resistant to frost was more readily precipitated in the presence of potassium chlorid, sodium chlorid, and zinc sulphate solutions than the albumen of plants capable of withstanding low temperatures.

Alfalfa growing in Missouri, M. F. MILLER (*Missouri Sta. Bul. 72, pp. 52, figs. 6, map 1*).—The extent of alfalfa culture in Missouri is described and general directions for growing and harvesting the crop are given.

The stiff subsoils of the State are considered responsible for most of the failures with the plant. It has been found that on upland soils that have never grown alfalfa or sweet clover inoculation is a benefit, while on bottom lands or on very fertile soil inoculation has little or no effect. Inoculation by means of inoculated soil is considered the surest and the simplest method. The best time to sow the seed in the State is between the middle of August and the middle of September.

The hybridization of barleys, R. H. BIFFEN (*Jour. Agr. Sci., 2 (1907), No. 2, pp. 183–206*).—This paper describes experiments on the hybridization of barley commencing in 1901. The history of this line of work is briefly reviewed and notes on the varieties used as parents are given.

The different pairs of characters investigated in numerous crosses of different species and varieties of barley were as follows: Sexless and staminate lateral florets, hermaphrodite and sexless lateral florets, staminate and hermaphrodite lateral florets, hooded or trifurcate and awned paleæ, black and white color in the paleæ, purple and white paleæ, narrow and broad glumes, lax and dense ears, adherent and nonadherent paleæ, brittle and tough rachis, awnless and hooded paleæ, and a number of minor characters. The correlation of the color of the paleæ to the color of the grain was also studied.

Experiments with sugar and fodder beets, T. REMY (*Fühling's Landw. Ztg., 56 (1907), Nos. 4, pp. 105–122; 6, pp. 185–202*).—These experiments consisted of variety tests of sugar and fodder beets, experiments in transplanting small beets in beet-seed culture, and observations on the food requirements and assimilation of seed beets.

The result of a variety test are summarized in the following table:

Comparative test of varieties of sugar beets.

Variety.	Yield per hectare.		Rank according to suga. production.	Sugar in the beet.	Rank according to sugar content.	Proportion of leaves to crowned beets.
	Beets.	Sugar.				
	Kg.	*Kg.*		*Per cent.*		*Per cent.*
Meyer Friedrichswerth	37,200	5,420	4	14.6	8	94.5
Vilmorin française riche	36,100	5,350	6	14.8	7	110.6
Breustedt Elite A	34,400	5,480	2	15.9	6	....
Mette Spezialität	34,000	5,410	5	15.9	6	110.4
Heine Vilmorin	33,600	5,520	1	16.4	4	129.0
Rieselfeldelite	32,900	5,520	1	16.7	2	95.4
Dippe Klein-Wanzleben	32,500	5,300	8	16.3	5	121.5
Frühe Klein-Wanzleben Original	32,200	5,470	3	17.0	1	....
Dippe zuckerreichste	31,800	5,310	7	16.7	2	93.3
Strube Schlanstedt	30,700	5,080	9	16.5	3	124.1

A number of cooperative tests conducted to determine the varieties of fodder beets best adapted to transplanting are described. The general results show that Cimbal Yellow Giant stood transplanting best, with Yellow Lentewitz a close second. It was also found that the weight of the mother beet had but little influence on its value as a seed producer. It is recommended that no more than one crop of transplanted beets for seed be grown between the selected beets and the commercial seed crop. It is believed that the use of small beets for seed culture has a tendency to deteriorate the form, and to overcome this tendency it is advised that greater care in the selection of mother beets according to form and to yield be exercised.

Experiments by other investigators on the food requirements of the seed sugar beet indicate that a yield of 3,000 kg. of seed per hectare removes from the soil 198.7 kg. of nitrogen, 219 kg. of potash, and 32.6 kg. of phosphoric acid, while those by the author indicate that 1,600 kg. of beet seed takes from the soil 38.9 kg. of nitrogen, 67.3 kg. of potash, 15.6 kg. of phosphoric acid, 25.5 kg. of lime, and 14.5 kg. of magnesia. It is stated that the production of 1,000 kg. of beet seed requires about the quantity of plant food necessary to produce 10,000 kg. of beets. The rate of consuming plant food was found to be quite uniform during the entire vegetative period. The rate of growth of the plants was quite closely correlated with the rate of plant food consumption. Only in the early stages of growth the quantity of plant food consumed was a little out of proportion to the growth made by the plant. The period of plant food consumption extended over 153 days.

It was further observed that the seed beet planted at the proper time ceases to take up food about 1 month earlier than the beet grown for sugar. The necessity of a good supply of plant food is greatest in the later period of growth of the seed beet as compared with the medium stage of development in the sugar beet. The period of plant food consumption in the seed beet is about 20 days shorter than it is in the first year of the sugar beet, but the quantity of nitrogen consumed is practically the same. The quantities of potash and phosphoric acid required for the seed beet are much greater than those demanded by the sugar beet, but the sugar beet uses the greater quantities of lime and magnesia.

Field corn in Arizona, V. A. CLARK (*Arizona Sta. Bul. 54, pp. 122–131, figs. 2*).—A number of varieties of corn tested are listed with reference to their resistance to a dry and hot climate and their tendency to attacks of smut and the corn earworm. The nonfilling of the ears is commonly attributed to the drying out of the pollen or silks. The filling of the ear in the varieties tested ranged from perfect filling, as in White Mexican Flint and a few other varieties, to the setting of practically no kernels at all, as in the King of Illinois. The most productive varieties were Chester County Mammoth, Large Yellow Dent, Queen of the Prairie, Griswold Bronze, Mexican White Flint, King Philip, Kellogg, and Blue Squaw. Mexican White Flint is considered the best variety for the region, although Kellogg and Blue Squaw, both flint varieties, also succeeded when it was so dry and hot that dent varieties failed. These 2 varieties are only moderately productive. High-bred strains of corn from the east proved to be more susceptible to attacks of worms and smut, and were more liable not to fertilize than less specialized and less highly selected varieties from the same region.

Brief notes are given of the varieties grown, which include Yellow Dent, White Dent, early Northern flints, and Western flint corns.

The advantage of planting heavy cotton seed, H. J. WEBBER and E. B. BOYKIN (*U. S. Dept. Agr., Farmers' Bul. 285, pp. 16, figs. 6*).—This bulletin presents the results of experiments in the separation of cotton seed, and discusses the advantage resulting from this practice, the importance of using heavy seed, the preparation of the seed, and the method of separation. Both the Sea Island and Upland cotton are described.

After separating the seed into 4 grades, heavy, medium, light, and very light, 500 seeds from each grade were found to weigh as follows: Heavy 81½ gm., medium 77½ gm., light 74½ gm., and the very light 62½ gm. A lot of seed was separated into heavy, medium, and light grades, and equal quantities of the three grades weighed 25¼ lbs., 22⅝ lbs., and 20⅝ lbs., respectively.

Of seed separated into 4 grades, heavy, medium, light, and very light, 350 seeds from each grade were planted in practically pure sand on March 2, 1906.

On March 16, 228 of the very light, 294 of the light, 273 of the medium, and 305 of the heavy seeds had germinated. In a test of heavy and of unseparated seed at Lamar, S. C., the yield of seed cotton from 20 rows from heavy seed was 103 lbs., or 10.9 per cent, greater than the yield from the unseparated seed. In a test at Hartsville, S. C., the heavy seed yielded 88.3 lbs. of seed cotton, or 8.25 per cent, more than the unseparated seed. It is pointed out that if the seed cotton is rated at 4 cts. a pound the differences in yields obtained at Lamar and Hartsville are approximately $4.12 and $3.55 per acre, respectively.

In connection with experiments in 1906 by W. A. Orton of this Department with Sea Island cotton seed in rows of equal length, the germination was as follows: Light seed 188 plants, heavy seed 327 plants, and unseparated seed 237 plants. A lot of 85 lbs. of Sea Island cotton seed, separated on a machine constructed on the plan of that devised and described by the authors of the bulletin, consisted of 76 lbs. of cleaned seed, 7½ lbs. of imperfect seed, and 1½ lbs. of cotton. It is believed that this separation might have been improved by running the cleaned seed through the separator a second time under an increased air blast, as the large percentage of cleaned seed indicates insufficient separation.

Comparative value of whole cotton seed and cotton-seed meal in fertilizing cotton, E. B. Boykin (*U. S. Dept. Agr., Farmers' Bul. 286, pp. 14, figs. 2*).—This bulletin discusses the use of cotton seed for a fertilizer, points out the profit to growers by disposing of the seed, suggests methods of cotton seed preservation, and reports the results of experiments conducted for 2 years, in which whole cotton seed and cotton-seed meal were compared as fertilizers for cotton. A dark sandy loam with a clay subsoil was selected for these tests. Forty bushels of seed per acre were compared with 600 lbs. of meal, 30 bu. with 450 lbs., and 20 bu. with 300 lbs.

It is believed that the results "amply justify the assumption that 900 lbs. of meal is at least equivalent to a ton of seed in effect on the crop; that is, on such land as was used for this experiment."

Varieties of cotton, 1905 and 1906, W. R. Perkins (*Mississippi Sta. Bul. 98, pp. 5*).—This bulletin is a brief report on variety tests with cotton for 1905 and 1906. In 1905 the difference in value of crop between the poorest and the best yield was $26.81 per acre, and in 1906, $19.25. In 1905 the leading varieties, based on the value produced per acre, were in the order mentioned: Cook Improved, Toole Early, Layton Improved, Truitt, and Lewis Prize; and in 1906 the 5 leading varieties on the same basis were Cook Improved, Cleveland Big Boll, Eureka, Triumph, and Peterkin.

Cowpeas, A. E. Grantham (*Missouri Sta. Bul. 73, pp. 60, figs. 9*).—It was ascertained that cowpeas can be grown successfully in all Missouri soils, and that as much forage can be produced from this crop in 80 days as red clover will yield in 15 months.

In the southern part of the State cowpeas may be planted with corn and cut together for silage to good advantage. In this part of the State, also, cowpeas may follow wheat or oats and produce a crop of hay or pasture before fall seeding. In northern Missouri this latter practice is successful only in favorable seasons or with an early maturing variety. It is stated that growing cowpeas not only increases the fertility of the soil, but also improves its physical condition, making it more open, friable, more easily worked, and increasing its moisture-holding capacity. The crop is also said to cause the soil to dry out earlier in the spring. The Whippoorwill variety is recommended for general purposes and the New Era for a catch crop or for a short season. When the peas are not to be cultivated 4 or 5 pk. of seed per acre is required, but if cultivation is to be given 5 to 8 qt. will be sufficient.

Experiments made at the station showed that Michigan Favorite, Warren New Hybrid, Warren Extra Early, Groite, Extra Early Blackeye, and New Era may be classed as early varieties: Early Black, Whippoorwill, Early Boolock, Iron, California Blackeye, and Black as medium early, and Red and Clay as late varieties. One bushel of seed per acre drilled seemed to be the most economical quantity to use, especially when seed is high. The difference in yield of cultivated and uncultivated plats seemed to be clearly in favor of those not cultivated.

A comparison of the meteorological records for June, July, August, and September shows that September is a more favorable month for haymaking than June, there being less rain, more clear days, a higher maximum temperature, and more wind.

The value of the cowpea crop is estimated at $12.80 per acre when grown for hay, and $13.75 per acre when grown for seed.

Observations on millets, V. A. Clark (*Arizona Sta. Bul. 54, pp. 118–121*).—Brief descriptions are given of cultural experiments with German, Hungarian, Hog, Japanese, Texas, and Pearl millets. Pearl, German, and Hungarian millets were most effective in keeping down weeds. In palatability these varieties also seemed to rank first. It is concluded that German millet is the best variety for that climate.

Soy bean varieties, C. R. Ball (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 98, pp. 28, pls. 5, figs. 2*).—The history of the soy bean and its variability are discussed, and the varieties classified in accordance with a key worked out for the purpose. Descriptions of 23 varieties are given, and they are classified according to the color of their seed into black-seeded, brown-seeded, mottled-seeded, green-seeded, greenish-yellow-seeded, and yellow-seeded groups. A list of synonyms is also given.

Investigations on the effect of nitrite and inoculating soil on soy beans, A. Stutzer (*Jour. Landw., 55 (1907), No. 1–2, pp. 78–80*).—These observations were made under pot culture and field conditions. The use of nitrite and sodium nitrate caused a luxuriant development of the plants, and no injurious effect from nitrite was observed. When the plants were taken up in the fall no root nodules were found.

In earlier experiments it was observed that nitrite produced an injurious effect on the germination of red clover seed, but no injurious results were noticed in connection with the germination of the soy beans.

The soil inoculation test was made with soil secured from a soy bean field in Japan. The first year only a few nodules were formed on the roots, but the second year when the crop was sown on the same plat the roots were provided with numerous nodules, showing that the nodule-producing bacteria had successfully survived the winter.

References to recent work in plant breeding, C. Fruwirth (*Jour. Landw., 55 (1907), No. 1–2, pp. 143–159*).—References are given to 36 articles and publications reporting work in plant breeding or discussing this subject.

A quick method for the determination of moisture in grain, E. Brown and J. W. T. Duvel (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 99, pp. 24, figs. 12*).—A method, with the apparatus required, for making complete moisture determinations of grain in from 20 to 25 minutes is described.

The work reported has reference mainly to the determination of moisture in corn, and the method described consists primarily in heating a definite quantity in an oil bath to drive off the water, which is condensed and measured in a graduated cylinder. The average moisture content of 28 samples of corn, as determined by this quick method, was 17.40 per cent, as compared with 17.26 per cent, the average of the determinations made in a water oven. Whole kernels were used in order to obviate the loss of water due to grinding. It was

found that a sample from the whole kernels gave 26.01 per cent of water, while the ground sample showed only 24.36 per cent. In another test the whole kernels showed 35.68 per cent of moisture and the ground kernels 34.75 per cent. Sixteen samples gave an average of 20.13 per cent for whole kernels and 20.05 per cent for ground kernels, the moisture content of the different samples varying from 12.71 per cent to 35.68 per cent.

The apparatus consists of an evaporating chamber with 2 or more compartments, a condenser, and a stand. One hundred grams of corn are used for the test so that each cubic centimeter of water in the graduated cylinder represents 1 per cent of moisture. When the thermometer in the distillation flask registers 190° C. the gas is turned off, and the reading of the amount of water expelled is made 8 or 10 minutes later. The oil used is a good grade of pure hydrocarbon oil with a flash point of 200° to 205° C. The oil is poured into the flask to first lessen the danger of its being broken by the kernels of corn dropping on the bottom.

Practical suggestions for seed testing, J. J. THORNBER (*Arizona Sta. Bul. 54, pp. 99-102, fig. 1*).—An apparatus for testing several kinds of seeds at the same time is described, and a number of purity and germination tests taken from a series of experiments carried on during the last 2 years are given in a table.

Attention is called to the fact that in 1 sample of alfalfa seed 90.6 per cent was pure seed, of which 95 per cent was viable, or 86 per cent of the total sample, while of another sample only 59 per cent was capable of growing. These 2 samples sold on the market for 15 and 16 cts. per pound, respectively. Two other samples sold for 16 cts. per pound, although 1 contained 29 per cent of inert matter. The samples of rye and barley tested were practically free from inert matter and weed seed, while the wheat contained about 9,000 weed seeds for every bushel. A 30 gm. sample of oats tested contained 10 varieties of weeds, represented by 298 seeds.

Seed inspection, C. D. WOODS and R. L. HAMMOND (*Maine Sta. Bul. 138, pp. 50*).—The requirements of the Maine seed law are briefly stated, and the results of the examination of samples of seed in 1906 are tabulated in detail. A list of the weed seeds found in these seeds is also given.

Pure versus poor seed, H. F. ROBERTS and G. F. FREEMAN (*Kansas Sta. Spec. Circ., Jan. 30, 1907, pp. 21*).—This circular compares the cost of obtaining a full stand of alfalfa when pure and poor seed are used, and also reports observations made with reference to blue grass and brome grass seed.

It is pointed out that in 1905, of the 1,018,206 acres devoted to the culture of forage crops, 602,560 acres was in alfalfa, and that the cost of seeding this acreage at the rate of 15 lbs. per acre with seed at 16 cts. per pound, every seed being good, would amount to $1,446,128, while taking as a basis from among the number of alfalfa seed samples analyzed by the station 28 showing an average of total impurities of 46.1 per cent and an average number of seeds true to name but incapable of germination of 34.5 per cent, it would have cost $1,935,042 to secure a full stand on the same area. The principal impurities found are dead and defective alfalfa seed itself, trefoil, English plantain or buckhorn, dodder, Russian thistle, crab grass, foxtail, and other weed seeds, and the adulterants are trefoil, bur clover, and sweet clover.

In a certain lot of seed analyzed at the station only 20.2 per cent was pure and capable of germinating. In order to obtain from the use of this pure seed as much of a stand as could have been secured from 15 lbs. of standard seed averaging 83 per cent of the seed true to name and capable of germinating, 73.9 lbs. would have been necessary, and the cost of seeding an acre would have been brought up to $11.92, as compared with $2.40 for the standard seed. The 28

samples referred to above ranged in impurities from 21.6 to 100 per cent, in trash or dirt from 0.3 to 31.9 per cent, and in the number of kinds of foreign seed present from 3 to 34 per cent.

The amount of English blue grass seed tested in the fall of 1905 contained less than 50 per cent of germinable seeds, and the percentage of weed seed was so high that on each acre there was sown with this seed 142,230 seeds of crab grass, 111,000 seeds of dock, 393,670 smartweed seeds, 62,340 cheat seeds, together with 111,000 miscellaneous seeds, making a grand total of 820,240 weed seeds of all kinds. The crop harvested from this seed contained only about 15 per cent of English bluegrass seed, while 79 per cent was cheat and such weeds as bindweed, dock, foxtail, and pigweed. A comparison of the different grades of seed estimated and determined by the station is given in the following table:

The cost per acre of standard and poor seeds compared.

Samples.	Good seeds.	Seed required per acre.	Cost of seeding an acre.	Germinable seed, cost per bushel.	Weed seeds per acre.	Weeds per square foot.
	Per ct.	*Lbs.*				
Alfalfa 201	52.0	28.7	$4.63	$19.21	93,910	2
Alfalfa 20	73.6	20.3	3.07	13.58	238,750	5
Alfalfa 215	66.3	22.5	3.63	15.00	313,730	7
Alfalfa 227	42.0	35.7	5.75	23.80	167,470	3
Alfalfa 267	20.3	73.9	11.92	49.26	4,241,950	105
Alfalfa standard	83.3	15.0	2.42	12.00	....	....
English blue grass 284	49.3	105.4	1.05	4.05	820,240	....
English blue grass 375	43.4	120.0	12.00	4.80	36,000	....
English blue grass standard	80.7	50.0	5.00	2.47	....	....
Brome grass 107	49.5	50.0	3.85	3.00	157,000	....
Brome grass 229	32.4	77.0	8.25	4.65	207,900	....
Brome grass standard	67.5	25.0	2.68	2.38	....	....

The seed law proposed for the State, requiring a guaranty of 85 per cent of germination and imposing a tax of one-fifth of a cent on all seed packets less than 1 lb. and of one-fifth of a cent per pound for all seed in bulk, is discussed.

The destruction of wild mustard by spraying and the influence of the weather on the effectiveness of this method, H. HENNEBERG (*Jour. Landw., 55 (1907), No. 1–2, pp. 93–121*).—An historical note on the destruction of wild mustard by spraying is given, and the results of a series of experiments are reported.

It is recommended to spray copiously when the wild mustard plants are still quite young and during a period of settled weather.

HORTICULTURE.

Report of the horticultural division, F. W. CARD, M. A. BLAKE, and H. L. BARNES (*Rhode Island Sta. Rpt. 1906, pp. 159–175, pls. 7*).—This is a report of the various horticultural investigations conducted at the station, of which the work on market-garden rotation, soil sterilization, and vegetable tent experiments have been continued from the previous year (E. S. R., 17, p. 861).

An attempt was made to exterminate charlock, or wild radish, from grain fields by spraying with the following solutions: Sixty pounds of copperas in 40 gals. of water, and 12 lbs. of copper sulphate in 40 gals. of water. The copper sulphate was applied June 8 and the copperas or iron sulphate June 14. The charlock was then in bloom and too tall to be effectually reached by the spray with the machine used. Judging from this experiment it is concluded that a spray of copper sulphate of the strength as here used, if applied in the earlier stages of the weed growth, would prove decidedly effective in destroying charlock, with no permanent injury to the grain crop.

A large number of grafting waxes were tested in the spring of 1905, and the formula of 2 parts resin to 1 part beeswax seems to be the best proportion to use. The wax can be made harder or softer by the use of more or less tallow or oil. Adding tallow to the wax does not produce lumps if not used to excess. Adding resin to a soft lumpy wax will render it smooth and pliable.

An extensive experiment was conducted in the summer of 1905 with lawn plats to test the influence of different fertilizers upon the permanence of white clover and certain grasses, and to compare the adaptability of different grasses and mixtures for lawns, golf links, and polo grounds. In all, 33 plats were included in the experiment. Fertilizers were used furnishing an acid, an alkaline, and a nearly neutral residue. The fertilizer ration used in all cases was as follows: Actual nitrogen per plat, 5.14 oz.; actual phosphoric acid, 6.17 oz., and actual potash, 15.42 oz., or at the rate of 50, 60, and 150 lbs., respectively, per acre. Notes are given explaining the character of lawn resulting from the different methods of treatment and varieties of grasses used. This experiment is illustrated by several plates.

The market-garden rotation experiment was designed to compare stable manure with chemicals in the growing of market garden crops, a cover crop being introduced wherever practicable. This experiment was begun in 1904, when the crop consisted of corn followed by beans on one part of the plat and beans followed by corn on the other. The plat receiving chemicals was on August 19, 1904, sown to timothy and clover, a fair amount of which lived through the winter and was plowed under in June, 1905. The stable manure plat received 1 cord of stable manure and the other plat 200 lbs. of chemical fertilizer, or at the rate of 10 cords of manure and 1 ton of chemicals per acre. Dwarf Stone tomatoes were planted upon both plats June 9, 1905, and the yields harvested from these 2 plats at the various pickings are tabulated. The plants upon the plat receiving the chemical fertilizer made a better start and remained ahead throughout the season. The total picking from August 29 to October 11 on the stable manure plat was 996 lbs. 6 oz., while the total picking for the same period on the chemical fertilizer plat was 1,347 lbs. 5 oz. At the end of the season there were 197 lbs. more green tomatoes and 84 lbs. more rotten tomatoes on the stable manure plat than on the chemical fertilizer plat. A larger proportion of ripe fruit was obtained earlier in the season from the use of chemicals than from the use of stable manure, which is believed to be due to the influence of nitrate of soda in hastening the maturity of the tomatoes.

A score card similar to the one used for strawberries has been adapted for raspberries and is shown here containing the scale of points and a key for the description of the plant.

The work with sterilized soil was continued in 1905, in which the methods of treatment were those formerly used (E. S. R., 17, p. 862), and are as follows: (1) Unsterilized, (2) sterilized and handled while hot, (3) sterilized and handled cold, (4) sterilized and sprinkled lightly with rich unsterilized soil to introduce soil organisms, (5) sterilized and treated with nitrate of soda. The work is discussed in detail. The crops used were radishes and lettuce, and the weights at harvesting obtained from the various soils are presented in tabular form. The radishes obtained from the sterilized soil, handled hot, were not only larger, but brighter in appearance, and those secured from sterilized soils, sprinkled with garden soil, were next as to weight. The lettuce in all plats made a very poor growth, and all the lettuce was pulled and the plats replanted with turnips on August 31. Judging from the weight of the turnips, the leaves of which were badly eaten by worms, the roots secured from soils sterilized and handled hot and from those sterilized and handled cold were practically the same. The radishes were succeeded by Marguerite carnations, and the number

of blooms which were picked at different intervals on the various soils are recorded.

In ge. ral, it is stated that as far as these tests go no particular gain has resulted from the reintroduction of soil organisms into a sterilized soil by sprinkling with unsterilized soil. Handling the sterilized soil while still hot appears to act beneficially on the crop.

During 1905, cauliflower was the only vegetable grown under tent covering, this vegetable having shown the greatest gain in the previous experiments. The ground outside the tent was very dry and the plants grown inside made a much better start and continued to make a better leaf growth throughout the summer. The ground inside the tent remained moist much longer after a rain than that outside. The yields of untrimmed and trimmed heads secured inside and outside the tent are tabulated. The proportionate net weight of trimmed to untrimmed cauliflower was 56 per cent in that grown outside and 64 per cent in that grown inside. The total weight of trimmed cauliflower was 60 per cent greater under the tent than outside. From the present experiment it appears that it is possible to grow cauliflower under tent covering in weather when it is almost impossible to secure it outside. The temperature readings, taken during the course of this experiment from June 16 to August 8, are here tabulated and show the average temperature during the day to have been nearly 4 degrees warmer inside the tent than outside. In one instance the inside temperature was 10 degrees higher than outside.

Investigations on the culture of asparagus in the vicinity of Auxerre, E. Rousseaux and C. Brioux (*Recherches sur la Culture de l'Asperge. Paris: Soc. Encouragement Indus. Nat., 1906, pp. 112*).—The authors have made extensive investigations of the culture of asparagus in the department of Yonne. In the present work consideration is given to cultural practices, the control of insect pests and fungus diseases, marketing, and the cost of production. The total cost per acre of one 15-year-old plantation at Charbuy is estimated at approximately $738.69 and the gross receipts as $1,293.07, leaving a net income per acre of $554.38, or about $36.95 per year.

The authors have conducted an investigation for 3 consecutive seasons at the experiment station for the department of Yonne, and at cooperative experimental farms, to determine the best method for fertilizing asparagus. In the determination of a well-balanced fertilizer formula studies were made and are here discussed of the physical and chemical composition of the soils of that region, the chemical composition of the plant as indicative of its need, and the chemical composition of the manures and compost ordinarily used near Auxerre to determine what complementary ingredients should be recommended.

As a result of these investigations the use of barnyard manure is recommended as a basis for all fertilizers, since it not only furnishes humus and improves the physical texture of the soil, but also aids in the retention of chemical fertilizers which may be added. On light sandy soils with a porous subsoil, the use per acre of from about 220 to 266 lbs. of basic slag, 175 lbs. of nitrate of soda, and 88 lbs. of sulphate of potash is recommended. The basic slag should be applied with the barnyard manure during winter. The sulphate of potash and about one-third of the nitrate of soda may be harrowed in lightly along the rows after the usual rainy period of spring. The remainder of the nitrate of soda should be applied in 2 applications, at the beginning of the cutting season and a few weeks later. On somewhat heavier sandy soils, in which the subsoil contains a considerable clay content, the authors recommend the use per acre of from 175 to 220 lbs. of superphosphate, 175 to 266 lbs. of nitrate of soda, and 88 to 134 lbs. of sulphate of potash. The heavier application should be given when the asparagus is in full bearing, or when it is impossible to obtain a sufficient

amount of stable manure. Although the use of stable manure is recommended in all cases, the following formula has produced good results when used alone: Mineral superphosphate 266 lbs., dried blood or steamed horn 220 lbs., nitrate of soda 220 lbs., and sulphate of potash 175 lbs. The effect of using these manures for several successive years has been to increase not only the quantity of asparagus gathered, but also the average weight and earliness.

Fruits and vegetables, E. B. FERRIS (*Mississippi Sta. Bul. 94, pp. 4–14, figs. 2*).—This is an account of variety and fertilizer tests, together with the marketing of fruits and vegetables, at the McNeill Branch Station for the season 1905. The work is of a similar nature to that of previous years (E. S. R., 17, p. 1066).

No definite conclusions have been reached as to the best varieties of strawberries, although the station uses the Klondyke, Lady Thompson, and Excelsior in its commercial patch. The Excelsior ripens earlier, but is not so good as either of the others when sowed at the same time. Klondyke and Lady Thompson are about equally prolific, although Klondyke is firmer and colors better. Lady Thompson is highly recommended for nearby markets.

In the fertilizer test the mixture used as a unit application per acre consisted of 200 lbs. cotton-seed meal, 200 lbs. acid phosphate, and 100 lbs. kainit, one-half being applied at the first cultivation after the picking season is over and the other half at the last cultivation in the fall. When the 3 fertilizing materials were used in the proportions given above, 2,620 qts. were gathered per acre. This yield was increased to 3,100 qts. where 1,000 lbs. of oyster shells was added to the above mixture. On the plat where the cotton-seed meal and kainit content remained normal and the acid phosphate was left out entirely, the yield was only 1,840 qts., which seems to show a marked effect of phosphoric acid as a food for the strawberry. For 2 years past the strawberry has been the most profitable truck crop grown at the station. The quality of the fruit during the first part of the season was superior to that of the previous year's crops, and this, together with better shipping facilities, made shipments to Birmingham, Chattanooga, Cincinnati, and St. Louis fairly profitable. From a little less than 2 acres 165 24-quart cases were sold, which brought the shippers net returns of $360. The total yields of good fruit, however, were considerably reduced owing to a hard rain in April.

Fertilizer tests have been conducted since 1903 in an orchard containing 98 Elberta peach trees. The trees came into bearing this year. Although the yield was fairly good, the quality of fruit is said to have been poor owing to attacks by insects. Data are given showing the amounts of the different kinds of fertilizer used and the yield of peaches. The results seem to indicate the preponderating influence of nitrogen rather than phosphoric acid, together with some benefits from potash, which has not been the case with other crops. No difference was noted in the color of the peaches owing to the presence or absence of potash soils under the trees. The peaches were not marketed to advantage, since the various varieties ripened at different intervals.

From the Greensboro orchard, together with some 20 trees of other varieties, were sold 105 crates, which netted the shippers $110. Sixty crates were sold from the Elberta orchard, netting $67.50. From the remainder of the crop 35 doz. 3-pt. cans of fruit were put up and disposed of at from $1.80 to $2 per dozen. The 6-basket ventilated peach crate is considered the most desirable shipping package. During the winter of 1906, 1,000 additional Elberta trees were set out, with the view of producing carload shipments of fruit.

None of the plums pears, or apples have as yet borne any fruit worth mentioning.

From the experiments at the station the author is of the opinion that it is almost folly to attempt to grow orchard crops without exercising every care possible to prevent insect pests and fungus diseases.

In the fertilizer test with asparagus a mixture of 250 lbs. of cotton-seed meal, 500 lbs. of cotton seed, 405 lbs. of acid phosphate, and 170 lbs. of kainit was taken as a unit application per acre, and gave a calculated yield of 1,168 lbs. of marketable asparagus during the spring of 1905. This yield was reduced when any of the fertilizer constituents in the above mixture were either altered in amount or left out. The cutting began on March 22 and continued until May 2, during which time 43 cases of 20 bunches each were sold, giving the shippers net returns of $58. The crop was considerably affected by rust.

The fertilizer test with beans was repeated in 1905 and a table is given showing the results in detail. The most prolific variety appears to be the Valentine, and the best fertilizer mixture one which contains 224 lbs. of cotton-seed meal, 112 lbs. of nitrate of soda, and 458 lbs. of acid phosphate per acre.

Notes are also given on a large number of other vegetables, including potatoes, beets, turnips, ruta-bagas, and kohl-rabi, which are proving successful market crops. In the fertilizer test with Irish potatoes 10 bu. of Tennessee-grown Red Triumph seed potatoes were used per acre. They were planted February 1 and dug on May 23. A mixture containing 214 lbs. of cotton-seed meal, 100 lbs. of nitrate of soda, 456 lbs. of acid phosphate, and 224 lbs. of kainit was taken as the unit application for an acre, which produced an average yield of 103 bu. per acre. This fertilizer proved better than any other combination tried. A test was made between home-grown Irish potato seed and Tennessee stock under similar conditions of planting, etc., and the northern-grown seed gave a yield of 101 bu. per acre, while the home-grown seed yielded but 70 bu. per acre. In a variety test with Irish potatoes the percentage of perfect stand was determined by actually counting the hills in each plat. Burbank again headed the list, giving a yield of 99 bu. per acre with only 60 per cent of a stand.

The test of different-size seed pieces was continued during 1905, with results similar to that of previous years. One-eye pieces yielded 97 bu. and required 350 lbs. of seed per acre. The yield and number of pounds of seed required increased as the size of the pieces increased, until with whole potatoes the size of hen eggs the yield was 140 bu. per acre, 1,560 lbs. of seed being required per acre. The cut seed sprouted fully 1 week earlier than the whole potatoes. Irish potatoes grown exclusively on the experimental plats yielded about 75 bu. per acre. A test was made of the "Lookout Mountain" potato, which did not appear to be of any real value. Fall Irish potatoes have been tried each year since 1902, but have never made much more than the seed planted.

Prior to 1905 the tomatoes were not successful, since the highest priced early fruit always rotted. In 1905 the tomatoes were sprayed with Bordeaux mixture and a wonderful improvement was noted. It is believed that with 2 or more applications of Bordeaux mixture during the season the rotting at the blossom end of the tomato may be effectually controlled.

First biennial report of the Wyoming State board of horticulture, A. NELSON (*Bien. Rpt. Wyo. Bd. Hort., 1 (1905–6), pp. 56, figs. 29*).—The State board of horticulture was organized chiefly for the purpose of holding, in conjunction with the horticultural societies, public meetings for the discussion of horticulture and kindred pursuits, for the collection of statistics and general information pertaining to the horticulture of Wyoming and elsewhere, and to organize and take charge of orchard, nursery, and fruit stock inspection work.

This report gives an account of the progress which has been made along these lines in 1905 and 1906, together with the Wyoming horticultural law by which

the board was created and the regulations adopted by the board. The nursery law and the work of the inspectors are explained in detail, and brief suggestions are given in regard to orchard culture and the purchasing of nursery stock, together with a list of varieties of all the important tree and small fruits, ornamental shrubs and shade trees recommended for planting in Wyoming. Many of the well-known orchard and shade-tree insect pests and diseases are briefly discussed and a summary by counties is given of the status of horticulture in Wyoming.

In an appendix several spraying formulas are given with brief explanations as to their use and application, with a list of manufacturers of spraying apparatus. The report is illustrated with photographs of specimen fruit trees, orchards, and other horticultural views in Wyoming.

Orchard notes, 1906, W. M. Munson (*Maine Sta. Bul. 139, pp. 51–64, figs. 2*).—This bulletin contains a report upon apple orchard experiments in Kennebec County, Me., which have been conducted for several seasons (E. S. R., 17, pp. 972 and 1156). The work included experiments in cultivation, mulching, fertilizing, orchard renovation, top-grafting, and the use of cover crops. Notes are also given on the station's dwarf pear orchard, together with suggestions for the planting and care of such orchards.

In the comparative study of cultivation and mulching, the growth of trees was essentially the same as in previous years, whereas the yield of fruit appeared to be better in some cases from the mulched trees. There were fewer cases of dying out among the Gravensteins on the mulched area than on the cultivated area. This is attributed to the less vigorous growth and better matured wood on the mulched area. The use of stable manure as compared with concentrated fertilizers showed little difference with respect to hardiness. The yield on the unfertilized part of the orchard appeared to be in favor of cultivation. On the fertilized portion of the orchard there was a difference of results depending on the variety cultivated. The Tolmans yielded much better where mulching was employed, while the Gravensteins showed a greater yield under cultivation. Summing up the work of the past 2 or 3 seasons, the author is of the opinion that there is an apparent advantage in the use of stable manure, which, however, is not great enough to warrant hauling it long distances. In this case concentrated fertilizers are more economical and give practically as good results.

In the work of orchard renovation, those trees which received no nitrogen in the fertilizer showed a decided lack of color and weak growth, indicative of neglect, while the plats receiving nitrogen, whether alone or in combination, showed a vigorous growth and a rich green foliage. The plat receiving all 3 elements gave the best results. Nitrogen appeared to be the lacking element in this particular orchard. Tabulated data are given showing the yield per tree in the renovation orchard for each year from 1903 to 1906, inclusive. The continued exhibition of individuality of character was noted as in the previous year. The bulletin includes notes and suggestions relative to the pruning of orchards.

Report of fruit experiment stations of Ontario, 1906, L. Woolverton et al. (*Ann. Rpt. Fruit Expt. Stas. Ontario, 13 (1906), pp. 71*).—This consists of a general report of the secretary as to the present condition of the fruit stations, outlines of the work for the past season and proposed experiments for the season of 1907, the financial report of the year, notes on the Dominion conference and the horticultural exhibition, together with a report by P. W. Hodgetts of the exhibit of the fruit experiment stations at the industrial exhibition of 1906, followed by a report of the inspector of fruit experiment stations, H. L. Hutt, and reports from a large number of experimenters as to the behavior of different varieties of orchard and small fruits as tested at various fruit stations throughout the provinces.

A list of varieties of vegetables recommended for general growing in the Province of Ontario is also given, including notes on varieties tested at the Essex vegetable station.

Rouge de Trèves. The best cider apple for export to Germany, M. TRUELLE (*Bul. Soc. Nat. Agr. France, 67 (1907), No. 2, pp. 187–197*).—With respect to apple growing in France, the author is of the opinion that in order to be profitable the grower must export a portion of the crop, and here recommends the Rouge de Trèves as an excellent cider apple, well liked by the German cider manufacturer. An account is given of the origin and area under cultivation of this apple, together with a description of the tree and fruit and tables of chemical analyses made by the author and others in regard to the composition of the fresh fruit, juice, and pulp. This apple is also said to be a good keeper and valued both for preserving and evaporation purposes.

The washing of fruits in formaldehyde, H. DE PARVILLE (*Ann. Soc. Hort. Allier, 11 (1906), No. 12, pp. 298–301*).—An extensive review is here given of an article published by the author in the *Journal des Débats* November 8, 1906, in which the experiments of G. Perrier in the sterilizing of apples by washing in a solution of formaldehyde are described.

The object sought was to destroy all germs of fermentation in order that the cider manufacturer might secure absolutely sterile must or unfermented juice, which could then be sown with either pure or selected mixed yeasts to correspond with the nature of the product desired.

With grapes, Pasteur found that the yeast germs accumulated on the surface of the fruit. The present investigator, finding the same to be true with apples, succeeded in sterilizing the fruit by immersing the apples for 15 to 24 hours in a solution containing 4 parts of formalin to 1,000 parts of water. When 8 parts of formalin were used to 1,000 parts of water the sterilization was effected in 5 minutes' time. This method is said to be used by a number of persons in preserving their fruit for the winter, but is not generally used in the manufacture of cider, since it is prohibited by the French food laws.

It is stated that must prepared from fruits sterilized in this manner contains but 0.0001 per cent, or 0.25 mg. of formalin to 100 gm. of the must, whereas many of our ordinary smoked food products have been found to contain from 0.4 to 2.5 mg. per 100 gm. of product.

A method of preventing the rapid decay of ripe fruit (*Jour. Bd. Agr. [London], 13 (1906), No. 9, pp. 562–565*).—The experiments conducted at Kew in 1905 in testing the preservative properties of formalin for preventing the rapid decay of ripe fruit gave satisfactory results, and together with the method of preserving the fruit in formalin have been noted (E. S. R., 17, p. 768).

A second series of experiments conducted in 1906 served to corroborate the results of the previous year. Aside from the treatment of fruits for preserving, formalin is recommended for the preservation of the winter supply of apples, which may be treated as follows: To 10 gal. of water in a cask or a zinc bath, add 1½ qts. of formalin, mix thoroughly, and immerse as many apples, contained in a sack, as the water will cover. Allow the fruit to remain in the solution for 10 minutes, then remove from the sack and place on a layer of straw or hay, or some suitable substance, and drain until dry. It is claimed that where the apples are intended for storage it is not necessary to immerse them in water after their removal from the formalin mixture.

When apples showing the first stage of apple rot were immersed for a quarter of an hour in a solution of formalin of the strength given above, the spread of the diseased spots was completely arrested, and the fruit kept in good condition for several weeks longer than untreated fruit.

Strawberries and their history, COUNT OF SOLMS-LAUBACH (*Bot. Ztg., 1. Abt., 65 (1907), Nos. 3–4, pp. 1–76*).—This is an historical study of the literature of the strawberry in respect to its botany, classification, and development of various forms, together with an extensive bibliography.

As a result of this study the author concludes that there are 7 real species of strawberries, which may be classed under 3 principal groups. The *Fragaria hagenbachiana* is believed to be a natural cross of *F. collina* and *F. vesca*. *F. grandiflora* (the pine strawberry) is believed by the author to have developed in Europe as the result of the cultivation of hybrids of *F. chiloënsis* and *F. virginiana*, contrary to the opinion of Bailey, who classes *F. grandiflora* as the variety Ananassa of *F. chiloënsis*.

Fundamental principles of modern viticulture, C. HUGUES (*Rivista, 4. ser., 13 (1907), No. 9, pp. 193–200*).—The author is of the opinion that modern grape growing depends upon the establishment of plantations with pure American graft-stocks or direct-bearers, especially in the production of table grapes. Consideration is given to the establishment of vineyards and selections of varieties for different soils, the use of chemical fertilizers and cover crops, and pruning as affecting the quantity and quality of the crop. The methods of planting, cultivation, and subsequent care are also discussed from an economic standpoint.

Reconstitution of the Algerian vineyards with plants resistant to phylloxera, E. VIVET (*Bul. Agr. Algérie et Tunisie, 13 (1907), Nos. 7, pp. 171–185; 8, pp. 204–211; 9, pp. 229–236, figs. 3*).—This article is introduced by an account of the destruction of Algerian vineyards by phylloxera and the attempt to reestablish them by the use of American vines. It consists principally of practical suggestions for the grape growers of the afflicted regions on the various phases of viticulture. Part 1 deals with a discussion of suitable varieties both of graft-stocks and direct bearers with respect to the different kinds of soil, including a study of the pure American species, American hybrids, and French-American hybrids. Part 2 consists of a discussion of nursery and seed-bed practices, including various methods of propagation and grafting, methods of planting, and subsequent care.

The export of table grapes, C. M. MILAN (*Prog. Agr. et Vit. (Ed. l'Est), 28 (1907), No. 18, pp. 535–538*).—Prior to 1904 it is stated that the bulk of French table grapes was disposed of in Paris, whereas in 1906 over 2,000 tons were exported to various European countries. The author gives suggestions to grape growers for the increase of this export trade by the selection of varieties of a good quality and recommends a list of desirable varieties for planting in different locations.

The importance of silica in viticulture, OBERLIN (*Rev. Vit., 27 (1907), No. 696, pp. 425–430*).—In the present article the author discusses the importance of the soil as a factor in the determination of the quality of wines, with special regard to its content of soluble silica, and cites many examples to show that the vineyards producing the more noted wines of France and Germany are grown on soils containing a considerable content of silica. The production of high-grade wines on soils which have a low silica content is said to be restricted to a few especially adapted varieties of grapes.

In order to confirm his belief that the presence of silica has an important effect on the quality of wine, the author has conducted several experiments, the first of which was attempted in 1886 and 1887, in which powdered sodium silicate was used as a fertilizer. As compared with the check, the must produced from vines grown on the fertilized plat was shown to have its density increased to the extent of 10 degrees. In 1889 the use of potassium silicate

gave similar results. Both of these fertilizers, however, proved to be too expensive for commercial purposes.

Further experiments were conducted in 1899 at the Oberlin Viticultural Institute at Colmar, in which the author used powdered phonolite obtained from the débris of a stone crusher used in connection with the macadamizing of roads. The powdered phonolite was applied for a period of 4 years, and the results which were noted in 1905 and 1906 are presented in tabular form. The author concludes that it is practically certain that the density of must is greatly increased by the addition of soluble silicates, and states that it remains to be proved whether the use of silica, especially in the form of phonolite, which was found to contain as high as 56 per cent of silicic acid, is not capable of increasing the alcoholic content of the wine, as well as augmenting its other good qualities.

The grape and wine industry in the provinces of Mendoza and San Juan, Argentina, T. Chiaromonte (*Bol. Uffic. Min. Agr., Indus. e Com.* [*Rome*], *6 (1907), I, No. 5, pp. 489–513*).—An account is given of grape culture and the manufacture of wine in these provinces, in which considerable data are presented in connection with various phases of the subject, special attention being paid to the effect of these industries on the sale of Italian wines.

The total area of irrigated vineyards in these regions is given as about 23,227 hectares (57,370 acres). The value of a 3-year-old vineyard is estimated at 1,829 pesos ($1,765). In Mendoza one-fourth of the grapevines are native and three-fourths of French origin, whereas in San Juan two-thirds of the vines are native and one-third of French origin. The annual production of wine in the Republic of Argentina is said to be about 2,000,000 hectoliters (52,800,000 gals.).

The quality of the different grades of wine is discussed, and tabulated data are given showing the production, importation, and consumption of beer for each year from 1902 to 1905 and of wine from 1894 to 1906.

Extensive and intensive culture of Brazilian coffee trees, C. Bolle (*Tropenpflanzer, 11 (1907), No. 2, pp. 69–79*).—The author gives an account of the different coffee zones in Brazil, and discusses the relative merits of the cultivation of coffee as the only crop on large plantations as compared with its cultivation in connection with other crops. After a comparison of these two methods he is of the opinion that the culture of coffee may be conducted with profit in either way.

Poppy culture and the production of opium, H. Thoms (*Über Mohnbau und Opiumgewinnung. Berlin: Borntraeger, 1907; rev. in Chem. Ztg., 31 (1907), No. 24, p. 316*).—The author's results in the cultivation of poppies in the experimental fields of the German Institute of Pharmacy at Dahlem during the years 1905 and 1906 are given.

These experiments further demonstrate the facts that the climate and soil are suited for the cultivation of the poppy and the production of opium rich in morphine in north as well as in south Germany. An account is given of the experiments that have been attempted with Prussian, Turkish, and blue and white German poppies with reference to the production of opium and its content of morphine and other opiates, the relative returns from the different varieties, the cost of production, etc. The author states that the production of opium in north Germany is not profitable, but appeals for experiments in the German colonies, since samples of opium in Kwai and west Africa were found to contain a high content of morphine.

What to do with old bulbs, J. Dunbar (*Gard. Mag.* [*N. Y.*], *5 (1907), No. 5, pp. 294, 295, figs. 10*).—Directions are given as to the harvesting, cleaning, and storing of such bulbs as tulips, hyacinths, and daffodils when the flowering season is over.

Danger in the repeated repotting of plants, A. PETIT (*Jardin, 21 (1907), No. 484, p. 118*).—The author performed experiments in order to determine the effect of different size pots and repotting on the growth of plants.

Several marigolds were grown in pots 9 cm., 14 cm., and 19 cm. in diameter, respectively, and in open ground. In each case the weight of 8 plants was taken. The growth of the plant was shown to increase with the size of the pot, the growth in open ground being far in excess of that of the pot-grown plants.

An experiment was also conducted with coleus and heliotrope plants, one portion of each being planted in pots of 7, 9, 12, and 15 cm. in diameter, respectively, while the other portion was repotted successively from the smallest to the largest of these pots. In every case, with the exception of the heliotrope growing in the pot 7 cm. in diameter, the average repotted plant weighed less than the plants started in their permanent position. A further experiment appears to show that the greater the number of repottings the smaller is the development of the resulting plant.

FORESTRY.

Forest planting leaflets (*U. S. Dept. Agr., Forest Serv. Circs. 76, pp. 3; 77, pp. 4; 82, pp. 8; 83, pp. 3; 84, pp. 4; 85, pp. 4; 86, pp. 3; 87, pp. 4; 88, pp. 5; 89, pp. 4; 90, pp. 3; 91, pp. 4; 92, pp. 4; 93, pp. 4; 94, pp. 3; 95, pp. 4*).—These leaflets treat of the form and size, habits and growth, economic uses, methods of propagation, planting, cultivation, and care of the following species of trees, which are given in order corresponding with the circular numbers above: Silver maple (*Acer saccharinum*), cottonwood (*Populus deltoides*), hardy catalpa (*Catalpa speciosa*), Russian mulberry (*Morus alba tatarica*), white ash (*Fraxinus americana*), slippery elm (*Ulmus pubescens*), boxelder (*Acer negundo*), white willow (*Salix alba*), black walnut (*Juglans nigra*), tamarack (*Larix laricina*), osage orange (*Toxylon pomiferum*), coffee tree (*Gymnocladus dioicus*), green ash (*Fraxinus lanceolata*), yellow poplar (*Liriodendron tulipifera*), black cherry (*Prunus serotina*), and sugar maple (*Acer saccharum*).

Forest planting in Illinois, R. S. KELLOGG (*U. S. Dept. Agr., Forest Serv. Circ. 81, pp. 32, figs. 2*).—In this circular are reported the results of an extensive study of forest plantations in Illinois to determine the kinds of trees best adapted for planting in prairie sections.

About two-thirds of the total area of the State was studied, although the work was confined chiefly to the central and northern portions. The results given are believed to be of general application throughout the State and to similar situations in Indiana, Missouri, and Iowa. In all, 117 plantations were visited and 22,500 trees measured. A description is given of the methods of study and species studied. The important features of the studies are presented in tabular form for each species, including location, age, area of plantation, planting distances, number of trees per acre, tree measurements, products, values, and annual income per acre.

Measurements were taken at the experimental forest plantation of the University of Illinois, which was planted in 1871 and covers an area of 13 acres, containing 20 species of forest trees. The best developed species in the plantation are European larch, white pine, green ash, and black walnut. Suggestions, with accompanying diagrams, are given for the planting and thinning of forest plantations and the formation of shelter belts.

Planting on New Mexico forest reserves, F. J. PHILLIPS (*Forestry Quart., 5 (1907), No. 1, pp. 11–19*).—Suggestions are given as to suitable species and methods for the reafforestation of these reserves, together with notes on their present condition. The author concludes that the degree of watershed development and suitable supply of forest products will determine to a great extent the future prosperity of the Territory of New Mexico.

The trees of Great Britain and Ireland, H. J. ELWES and A. HENRY (*Edinburgh: Authors, 1906, pp. XVI+200, pls. 61*).—This is volume 1 of an extensive treatise, in which the authors aim to give a complete account of all the trees either native to or cultivated in Great Britain which have attained or seem likely to attain sufficient size to warrant their consideration as timber trees. About 300 species are to be considered, the most of which the authors state have been the subject of their personal study.

The present volume consists of 2 parts. In part 1 the several species of the following genera are identified: Fagus, ailanthus, sophora, araucaria, ginkgo, liriodendron, spruce-firs, taxus, cryptomeria, pyrus, taxodium, and thuya. The history and distribution of each in various countries are considered and an account is given of the cultivation, soil, and location, together with descriptions of the remarkable trees of those varieties which occur in Great Britain. Attention is also paid to the use of the various trees for timber or other purposes.

Part 2 is devoted to illustrations of the species discussed, including specimen trees and interesting woods and plantations.

Location, date of latest proclamation, and area of the National forest reserves in the United States, Alaska, and Porto Rico (*U. S. Dept. Agr., Forest Serv. [Circ.], Feb. 1, 1907, pp. 4*).—The data indicated in the title are presented in tabular form.

The total number of forest reserves in the United States is 136, with an area of 123,850,161 acres; in Alaska 2, with an area of 4,909,880 acres, and in Porto Rico 1, with an area of 65,950 acres, making a grand total of 139 forest reserves, including 128,825,991 acres.

The timber supply of the United States, R. S. KELLOGG (*U. S. Dept. Agr., Forest Serv. Circ. 97, pp. 16, figs. 2*).—This circular, a brief summary of which has been previously noted (E. S. R., 18, p. 944), contains a discussion of the available timber supply of the United States and the length of time it will last at the present rate of cutting. A large number of statistics are brought together from different sources as to the annual output of forest products, the lumber cut, the geographical distribution of the total lumber product, and estimates of the stumpage of the United States at various periods, together with a recent estimate of the stumpage of the Pacific coast.

A map is given indicating the general distribution and character of the original forests of the United States, which shows the natural timber areas of the country to be embraced in 5 groups of States, as follows: Northeastern States, Southern States, the Lake States, the Rocky Mountain States, and the Pacific States. In the 2 latter groups practically all the timber-producing trees are coniferous, while in the first 3 groups both conifers and hard woods are found.

Four types of forests are produced in the Southern States. The swamp areas of the Atlantic and Gulf coasts furnish cypress and hard woods, and the plains from Virginia to Texas southern or yellow pine. Pure hard woods are found in the plateau encircling the Appalachian range, while the higher ridges contain spruce, white pine, and hemlock. The Lake States still contain many hard-wood forests in the southern portions, and pine, tamarack, cedar, and hemlock in the northern areas. The chief timber trees of the Rocky Mountain forests are western yellow and lodgepole pine, and those of the Pacific forests are Douglas firs, western hemlock, sugar and western yellow pine, redwood, and cedar.

The author asserts that it is unquestionably safe to say that our present annual consumption of wood in all forms is from 3 to 4 times as great as the annual increment of our forests. A chart is given showing the course of prices of white pine, yellow poplar, and hemlock since 1887 and of yellow pine since 1894. The most liberal estimate as to the wooded area of the United States

places it at 700,000,000 acres, whereas it is estimated by others as low as 500,000,000 acres. From a table showing the extent and ownership of forest areas in this country it appears that only one-fifth of our forest area is in National or State forests, the remainder being either in private hands or likely to pass into private hands. It is estimated that the present cut of forest products requires at least 20,000,000,000 cu. ft. of wood, and that under the present conditions of mismanagement the average annual increment is less than 10 cu. ft. per acre for the entire area, whereas an annual increment of 30 cu. ft. per acre is required to maintain the supply of timber now consumed annually.

The bulletin concludes with several quotations from an article by Fernow on the financial management of forests in Saxony and Prussia (E. S. R., 18, p. 741), with reference to the adoption of a settled policy of forest management, based upon the cutting of the increment only, without lessening the wood capital.

The lumber industry in the mountains of British Columbia, F. W. JONES (*Canad. Forestry Jour., 3 (1907), No. 1, pp. 31–42, pl. 1*).—In this paper, read before the forestry convention, Vancouver, September, 1906, consideration is given to the needs of the lumbering industry in relation to forest preservation. The author discusses the existing forest regulations and offers suggestions for the betterment of laws dealing with fires, the securing of more definite regulations covering the difference between agricultural and timber lands, the inauguration of a campaign of education as to the importance of preserving standing timber, and an amendment of the provincial regulations in order to provide for such tenure and terms on timber licenses that the lumbermen will be able to pay some attention to forestry principles in carrying on their operations.

Notes re timbers of Western Australia suitable for railways, engineering works, and constructional purposes generally, N. J. MOORE (*Perth: Govt., 1906, pp. 36, figs. 17, map 1*).—These notes include a discussion of the timber resources of Western Australia, forest areas and distribution, brief general descriptions of the principal trees and timbers, the available supplies of timber for commercial and other purposes, the economic uses of the principal timbers of the State, their physical characteristics, and their resistance to the teredo, white ant, and dry rot.

A report is also given by the chief engineer of existing lines, W. W. Dartnall, on the use of Western Australia hard woods for railway ties. The species of timber chiefly used is Jarrah (*Eucalyptus marginata*). The total number used on railways, including renewals, has been from 4,000,000 to 5,000,000. The present size of the sleeper is 7 ft. by 9 in. by 4½ in.

The text is accompanied by statistical data in regard to the climate of Western Australia, timber exports from 1895 to 1904, the strength of Western Australia timbers, information concerning timber shipping ports, forest working laws, and several illustrations of Western Australia trees and lumbering operations, together with a sketch map of the southwest portion of Western Australia, showing the approximate position of the principal timber forests.

Quantity and character of creosote in well-preserved timbers, G. ALLEMAN (*U. S. Dept. Agr., Forest Serv. Circ. 98, pp. 16, figs. 2*).—Recent reports on the service of creosoted railroad cross-ties and piles placed in salt water are said to show clearly that while proper treatment gives remarkably good results, much of this timber was improperly treated and has not lasted as it should.

This circular contains an account of the results, together with a description and discussion, of a series of analyses of the oils present in such forms of creosoted timber as have given long service. The work is introduced by a brief account of the source, composition, and production of coal-tar creosote. Numer-

ous statistics are also given as to the production and importation of creosote at different periods since 1898, from which it would appear that about 7,700,000 gal. of creosote oil were used in this country in 1903 for the impregnation of timber. This amount increased to about 8,650,000 gal. in 1904, and to 13,550,000 gal. in 1905. A description is given of the methods of extracting creosote from timber and analyzing the extracted creosote.

Analyses were made of 37 samples of wood, consisting of railroad ties, piles, and paving blocks of English and American origin, and one sample of conduit pipe. The analytical results are tabulated and discussed.

Woods used for packing boxes in New England, J. P. Wentling (*U. S. Dept. Agr., Forest Serv. Circ. 78, pp. 4*).—In this circular, statistics compiled from answers to questions sent to box manufacturers throughout New England are given, showing the kinds, quantity, and value of wood used in 344 box factories in the 6 New England States during 1905.

The white pine is the leading box material of New England, furnishing 81.8 per cent of a total consumption of 600,493,000 board ft., or more than 4 times as much as all other kinds combined. Spruce, which is used largely in the manufacture of butter boxes, comes next with 9.9 per cent. The other woods used are hemlock, beech, birch, maple, fir, poplar, chestnut, and basswood. The consumption of 138 factories in Massachusetts was 290,226,000 ft. of lumber, or nearly as much as the 5 other States combined. The total cost reported was $7,871,500, of which white pine comprised $6,463,500, or 82.1 per cent. The average cost per 1,000 ft. for each species is given.

"Wood to be suitable for high-grade box making must be strong and tough, so that it can be utilized without splitting; light, to facilitate handling and lessen freight charges; odorless, so that it will not taint the contents of the box; and preferably light in color." Since white pine largely meets these conditions, is easily worked, and seasons well, it is considered the ideal wood for the box maker. Box manufacturers of New England depend for their supply of lumber mainly upon the farmers' woodlots, and it is believed that if the cut of the available stand continues at the present rate the supply will be exhausted before the present young growth reaches a marketable size.

In order to illustrate the possibilities of forest growth in New England a table is given showing the areas of farm, forest, brush, and waste land in the different States. It is believed that the 10,000,000 acres of waste land, which at present is yielding scarcely any return, if forested and properly managed would eventually yield each year more lumber than the entire cut of white pine in New England in 1905. Suggestions for increasing the supply of white pine in New England have been previously noted (E. S. R., 16, p. 57; 17, p. 772).

The control of forest fires at McCloud, California, A. W. Cooper and P. D. Kelleter (*U. S. Dept. Agr., Forest Serv. Circ. 79, pp. 16, fig. 1*).—In 1904 the Forest Service, in cooperation with the State of California, made a thorough study of forest conditions in their relation to fire on the tract of the McCloud River Lumber Company, in Siskiyou County, California, with the primary object of devising a practical scheme of fire protection, particularly for the logged lands on which fires are most prevalent. The results of this study showed that adequate protective measures could be carried out at a cost justified by the benefits obtained, and a plan of protection was prepared and submitted to the company.

This circular contains a description of the tract in question, with reference to its area and timber content, notes as to the causes and effect of forest fires, and a description of the plan as submitted and as executed by the Forest Service in cooperation with the lumber company. The plan included the construction of fire lines, a telephone and patrol system, and the equipment of a

tool station, at an estimated cost for the first year of $645 per township, or about 3 cts. per acre. In beginning the work about 15,000 acres were set apart for protection, but owing to the contour of the country about 70,000 acres were actually patrolled. The patrol of the 70,000 acres cost less than one-half cent per acre. The total cost for the 15,000 acres, including construction of fire lines, was 2 cents per acre. Based on the year's work the estimated total cost of the protection for a period of 40 years is given as $1,634.92 initial expense and $542.88 annual expense thereafter. The probable net returns from the experimental area at the end of 40 years are presented in tabular form, in which the price per acre is estimated at $3, $4, $5, and $6, respectively, and the interest on the investment compounded at 3, 4, and 5 per cent, respectively. At the interest rate of 5 per cent and the valuation of only $3 per acre for stumpage it is figured that the net receipts will be over $45,000.

In conclusion the authors state that fire protection as practiced at McCloud has met with success, but that each tract offers local conditions of its own which must largely determine the character of the plan.

DISEASES OF PLANTS.

Results of experiments to test the adhesiveness of some copper fungicides, W. Kelhofer (*Ztschr. Pflanzenkrank., 17 (1907), No. 1, pp. 1–12, pl. 1*).—A series of experiments was carried on to test the adhesiveness of a number of copper fungicides. Grape leaves were sprayed with fungicides containing calculated amounts of copper, after which they were allowed to dry for 24 hours. The leaves were then split along the midrib and one-half subjected to artificial rain for an hour or more. Both halves were analyzed, and the differences in the amount of copper expressed in percentages were taken to represent the amount or proportion of adhesiveness.

In the first series, after subjecting the leaves for one hour to a rainfall amounting to 20.4 mm., the proportions of the fungicides still remaining were as follows: Copper sulphate solution 9.7 per cent, azurin 44.7 per cent, 2 per cent Bordeaux mixture 60.7 per cent, Bordeaux mixture in which 1 part of lime to 2 parts of copper sulphate was used 67.8 per cent, Bordeaux mixture in which 3 parts of lime to 2 of copper sulphate was used 38.1 per cent, Burgundy mixture slightly alkaline 68 per cent and strongly alkaline 40.7 per cent.

The addition of sugar at the rate of 100 gm. to each hectoliter of solution was tested with Bordeaux mixture, Burgundy mixture, and neutral and basic verdigris solutions. The Bordeaux mixture was less adhesive when sugar was added, but little difference was noted due to its addition to Burgundy mixture or to neutral verdigris, while its addition to the basic verdigris solution greatly increased the adhesiveness of the fungicide.

When subjected to a light rainfall amounting to 16.9 mm. in 24 hours the adhesiveness of the Burgundy mixture seemed greatly reduced, while the precipitate formed by Bordeaux mixture was less affected. This was attributed to changes induced by atmospheric phenomena, especially the presence of ammonium nitrate and carbonic acid in the air. A number of glass plates were sprayed with Bordeaux mixture and Burgundy mixture, and after drying were washed with water containing ammonium nitrate and carbonic acid, with the result that less of the Bordeaux mixture was removed than of the Burgundy mixture. The carbonic acid in this experiment removed more of the fungicide than the ammonium nitrate. In both cases the adhesiveness was in proportion to the alkalinity of the fungicide.

In concluding his investigations the author recommends for practical purposes spraying with Bordeaux mixture which is made slightly alkaline by an excess of lime.

Report of the botanist for 1906, G. P. CLINTON (*Connecticut State Sta. Rpt. 1906, pt. 5, pp. 307–368, pls. 16*).—The author reports on miscellaneous fungus diseases, experiments to prevent onion brittle, the dry rot fungus, and the root rot of tobacco.

A number of diseases that were more or less injurious are briefly described, and notes given on others which are either but recently recognized as occurring in the State or which have only recently become of economic importance. Among the latter class a description is given of an injury to the apple tree caused by the joint effect of freezing and attacks of canker (*Sphæropsis malorum*). A leaf scorch of beans which resembles in some respects a bacterial blight, but which failed on examination to reveal either bacteria or fungi, is briefly described, as are also a leaf spot of carnations, due to *Alternaria* sp., the black rot of cauliflower (*Pseudomonas campestris*), and the black mold of corn, caused by *Cladosporium zeæ*. Notes are given on the bitter rot of the grape and on the shelling of grapes which is usually attributed to some nonparasitic causes. The author states that in connection with this disease he has found the fruiting stages of a species of Macrophoma, but for the present the fungus is considered to be a saprophyte.

A yellowing of the leaves of oats, probably due to unfavorable weather conditions, is briefly described, and an account is given of a physiological trouble of peaches which resulted in an early defoliation of the trees. A root injury or rot of peonies, due to an undetermined cause, is said to have been quite serious, and the author records its occurrence and will continue his studies upon it. The leaf blight of pine due to *Hypoderma desmazierii*, pine rust, and winter injury of white pine trees are briefly characterized. An account is given of the wilt of raspberries, due to the fungus *Leptosphæria coniothyrium*. This wilt developed rather suddenly during wet weather in June, and an examination showed the presence of the fungus at the base or underground portion of the plant. Subsequent investigations showed that it also attacked the berries, spreading from berry to berry in a cluster, and the author is of the opinion that the infection in this case took place in the flowers and very young fruit, the spores being carried by bees or other insects. Spraying experiments were conducted for the control of this disease with but little effect.

A number of diseases of tobacco are described, among them the bed rot (*Corticium vagum solani*), a bacterial canker, damping off, root rot caused by *Thielavia basicola*, and a stem rot. The bed rot, which was more or less troublesome, resembles in some respects the disease attributed to Sclerotinia in the previous report (E. S. R., 18, p. 48). While considerable injury is done by the Rhizoctonia stage of Corticium, the more common damping off agent in the seed beds of the State is said to be Sclerotinia. For the control of the stem rot or damping off, the writer suggests sprinkling or spraying the tobacco beds where the disease is present with a weak solution of formalin. If used at the rate of 1 part to 1,500 of water the disease may be kept in check without serious injury to the seedlings. The sterilization of the soil by soaking with stronger solutions or by heat is also recommended.

A white spot of turnips, due to *Cercosporella albo-maculans*, a leaf spot of Russian vetches caused by *Ascochyta viciæ*, and an anthracnose of violets attributed to *Marsonia violæ*, are described.

A series of experiments was carried on to prevent onion brittle, a description of which is given in the previous report of the station (E. S. R., 18, p. 48). The experiments for the control of this disease were carried on in a field where it had first appeared 2 years before, and the treatments consisted of the application of formalin at the rate of 1 to 240 parts of water, limoid at the rate of 700 lbs. per acre, sulphur and limoid, and a complete fertilizer. In each case

after the seed was sown, the fungicide was sprinkled or scattered over it and the adjacent earth before covering. The fertilizer was scattered directly over the rows after the seed was covered. At the time of the harvest the yield of the different plats was as follows: Check plat 121 bu. per acre, formalin treatment 205, limoid 202, sulphur and limoid 191, and complete fertilizer 15. Another series of experiments was conducted in which similar treatments were given plats of onions after the disease had made its appearance, but in no case was any appreciable benefit found that could be attributed to the use of the remedy. While these yields are not equal to the average during a favorable season, yet for the treated plats they were greater than the average yield in the best untreated, uninfected areas.

A study was made of the dry rot fungus (*Merulius lacrymans*), the author's attention having been called to its rapid spread in the timber of a building. The nature of the injury, character of the growth, and damage caused are described, after which the preventive measures which were suggested are outlined. These consisted in the removal of the infected woodwork, provision for drainage in order that the walls of the building should not become damp, and spraying the portions of the building where the wainscoting had been removed with formalin and carbolic acid.

Particular attention during the past season was given to the root rot of tobacco (*Thielavia basicola*). This disease has become a serious pest in certain fields in Connecticut, and while probably not new, has only recently attracted the attention of tobacco growers. The history of the fungus, its nature, distribution, etc., are given at some length, after which an account is presented of the investigations carried on in Connecticut. In some respects the fungus resembles the damping off in the seed bed, but it is quite distinct from it in that the root rot develops almost entirely under ground, attacking the roots and underground portions of the stems. The grower first notices the presence of the disease by his plants failing to make normal growth and their unhealthy, dark-green color. An examination was made of fields and seed beds in a number of localities throughout the State, which resulted in the discovery that the fungus is widely distributed. Experiments were conducted both in the seed beds and in the fields for the control of this trouble, and following the recommendations of A. D. Shamel of this Department, who is cooperating with the station in tobacco investigations, sprinkling the seed beds with a solution of formaldehyde, 1 to 2,000 of water, was tested without much effect. The sterilization of the soil, either by the use of stronger solutions of formaldehyde or by steam, it is believed would be an efficient method of combating this disease in the seed bed. In the fields the experiments were carried on to test the effect of transplanting diseased plants, the effect of transplanting healthy plants into infected soil, and the effect of environment on the development of the disease. There appears from the results of the experiments to be no reason why the best plants from infected beds may not be safely transplanted to the fields, but those which have been to any extent attacked by the fungus should not be transplanted. The setting of healthy plants in infected soil showed that the disease was readily transmitted from the soil to them, and it was found that the character of the soil, subsoil, season, drainage, humus, and the kind of fertilizer, all have much to do with determining the amount of injury caused by the fungus. Based upon the investigations of the one season, the author suggests various measures for preventing the spread of the fungus and injury due to it.

The report concludes with a list of references to the literature relating to this root rot.

Alfalfa root rot, J. J. Thornber (*Arizona Sta. Rpt. 1906, pp. 160–162*).—Alfalfa throughout southern Arizona is said to be subject to a root rot which is

due to attacks of an underground fungus causing the plants to die out in well-defined, usually circular areas or spots. Upon examination the tap roots are found to be diseased and commonly in a well-advanced stage of decay, so that with a little effort they may be pulled from the ground to a depth of 12 to 20 in. The attack of the fungus upon the roots usually stops a little below the surface of the ground, leaving attached to the crowns one or more uninjured root stubs. During hot, dry periods, such as occur in that region, the plants quickly die from inability to absorb moisture.

The first sign of disease on the plants is characterized by the yellowing or wilting, and upon careful examination there will be found distributed over the surface of the roots numerous sterile filaments which frequently form masses of dark-brown mycelium. The fruiting or spore-bearing stage of the fungus is said to develop discontinuously upon the ground along the outer margin of the zone of dying plants and immediately above the matted mycelium. The spore-bearing portions are described as flattened, cushion-like, filamentous masses, 2 to 10 in. or more in extent and ¼ in. in thickness. During the younger stages this mass is a creamy-white color, but in age becomes yellowish-brown and breaks up into a fine, powdery spore mass. The sterile mycelium is technically described and measurements are given for the spores. It appears that the spores retain their power of germination for at least a year. So far as this publication is concerned, the fungus has not been definitely identified. It is believed that resistant strains of alfalfa may be obtained to use in seeding infected areas.

Potato scab, W. J. Morse (*Maine Sta. Bul. 141, pp. 81–92*).—According to the author, the amount of potato scab is rapidly increasing in various portions of Maine, and the object of the bulletin is to warn growers of the gravity of the situation, and to suggest methods for control of the disease. After describing the cause of the scab, the conditions favorable for its development, and the management of infested soils, the author describes the formaldehyde treatment both in the form of gas and as a disinfecting solution for the prevention of the scab. For large quantities of seed he recommends the use of formaldehyde gas generated by the use of potassium permanganate as the most practical disinfecting agent.

The effects of some fungicides recommended for the prevention of stinking smut on the germination of wheat, G. L. Sutton and J. T. Pridham (*Agr. Gaz. N. S. Wales, 18 (1907), No. 3, pp. 235–253, figs. 10*).—The authors carried on a series of experiments in plats, boxes, etc., to determine the effects of fungicides on the germination of wheat under various conditions of experimentation.

In the first series 18 varieties of wheat were treated with hot water, formalin, copper sulphate, copper sulphate solution and slaked lime, and copper sulphate solution and lime water to determine whether the treatment would have an injurious effect on seed grain. From the tabular statements presented it is seen that the germination was retarded to some extent by the different treatments in the following order, beginning with the treatment which retarded the germination least: Formalin, copper sulphate and slaked lime, copper sulphate and lime water, hot water, and copper sulphate. The ameliorating effect of lime used after the copper-sulphate treatment is clearly indicated by this experiment, and the authors recommend its use either in the form of slaked lime or lime water whenever seed is treated with copper sulphate.

A second series of experiments was conducted to ascertain whether it is advisable to treat the seed just prior to planting or whether it may be done with safety some time before planting. These experiments were divided into two parts. In one the seed was spread in the sun and dried immediately after

treating, while in the other the seed was not dried but was hung in bags in an open shed so that the superfluous moisture would drain away. The results obtained are not altogether conclusive, as beyond the fact that the seed treated with hot water became moldy and half rotten but little effect was noted which could be attributed to the treatment.

In testing the relative merits of the different treatments for the prevention of smut, formalin and copper sulphate treatments were used, and the efficiency of the copper sulphate was found to be in proportion to the strength of solution. Where copper sulphate in the proportion of 1 part to 100 was used its efficiency was about the same as where formalin was employed.

A series of experiments to determine whether formalin or copper sulphate treatment would prevent reinfection with smut was carried on with a number of varieties of wheat, in which the seed was treated and afterwards infected by the introduction of a large number of spores of the fungus. This series of experiments indicated that the protective layer or film of copper about the seed is quite beneficial, while formalin, as a protection against reinfection, has but slight effect.

In experiments to determine the effect of the different fungicides on seed grain when planted in ground too dry for the seed to germinate, the results varied with the different varieties. It appears that for seed lying dormant in dry soil for a period of 4 months there is no need of a protective film such as would be deposited by the fungicide.

Ustilago maydis on the adventitious roots of corn, J. Chifflot (*Compt. Rend. Acad. Sci. [Paris], 144 (1907), No. 14, pp. 764–766*).—The author reports having observed on the adventitious roots of maize undoubted evidences of corn smut, and by inoculations he was able to produce the hypertrophied tissues characteristic of the presence of the fungus.

The raising of strains of plants resistant to fungus diseases, E. E. Salmon (*Report of the Third International Conference, 1906, on Genetics. London: Roy. Hort. Soc., 1907, pp. 378–384*).—The author calls attention to the desirability of investigators devoting their work more largely to the raising of cultivated plants which are resistant to fungus diseases, and points out the varying susceptibility of different individuals to parasitism. He also states that different varieties of cultivated plants show very different constitutions with respect to fungus diseases, and that where such constitutional characters have been tested they have been found to be fixed for the species, variety, or race, and to transmit their immunity or susceptibility to their progeny, the characters appearing unchanged in the hybrids.

Ascogenous forms of Glœosporium and Colletotrichum, C. L. Shear and Anna K. Wood (*Bot. Gaz., 43 (1907), No. 4, pp. 259–266*).—On account of the importance of better information regarding the life histories of fungi, the authors studied a number of forms and have succeeded in growing both the conidial and ascogenous stages from 8 different hosts, as follows: *Glœosporium rufomaculans* from grapes, *G. fructigenum* from the apple, an apparently undescribed Glœosporium from the cranberry, *G. elasticæ* from the leaves of the rubber plant, a form from the honey locust, one from *Ginkgo biloba*, *Colletotrichum gossypii* from cotton, and *C. lindemuthianum* from cultivated beans. Of these the ascogenous form of only one had been hitherto reported.

The authors found that in attempting to make pure cultures they would frequently fail to secure the ascogenous form, but that once obtained it could be successfully grown on various media and under various conditions for several generations.

Heretofore forms of these fungi occurring on different host plants have been regarded as distinct species, but the authors' studies have led to the conclusion

that they can not be successfully segregated as species, as they were unable to find differences other than the host plant of sufficient constancy or importance to distinguish the species or even varieties. On this account the authors are for the present disposed to regard the various forms as varieties of one species, and for reasons presented they refer them all to *Glomerella rufomaculans*, which was originally described from specimens from the grape. A brief account of these investigations has been given elsewhere (E. S. R., 18, p 946).

An account of the genus Pythium and some Chytridiaceæ, E. J. BUTLER (*Mem. Dept. Agr. India, Bot. Ser., 1 (1907), No. 5, pp. 161, pls. 10*).—A monographic study is given of the genus Pythium, in which the biology, phylogeny, and systematic relations are described. Most of the species are said to be saprophytic, although some have become hemisaprophytic, causing destructive plant diseases. In this respect they resemble parasites, although their best development occurs when living as saprophytes.

Observations are given on some Chytridiaceæ which are parasitic on aquatic Saprolegniaceæ, etc., and a number of new species of the different genera are described.

Diseases of fruit and fruit-bearing plants (*London: Bd. Agr. and Fisheries, 1906, pp. 13, charts 7*).—A series of colored charts with explanatory text illustrating and describing the gross characters of a number of the more prevalent fungus diseases of fruits and fruit-bearing plants, and giving suggestions for their control or eradication. The charts are intended for hanging in school or lecture rooms, and the diseases illustrated are strawberry leaf-spot, strawberry mildew, apple rot, cherry scab, apple mildew, apple canker, heart-wood rot, tree-root rot, bladder plums, peach leaf-curl, shot-hole fungus, leaf blight, apple scab, pear scab, brown rot, vine leaf-blotch, vine leaf-scorch, black rot of vine, powdery mildew of vine, pear leaf cluster-cups, apricot rust, American gooseberry disease, walnut leaf-blotch, cherry leaf-blotch, hazel mildew, and silver leaf.

The scab of apples and pears, E. VOGES (*Deut. Landw. Presse, 34 (1907), Nos. 33, pp. 276, 277; 34, pp. 284, 285; 35, pp. 290, 291, figs. 17*).—An account is given of the biology of the species of Fusicladium that cause the scab of apples, pears, and cherries. The organisms are described at length and the methods by which they gain entrance to the host plant, the effect produced on the hosts, the methods of propagation of the fungi, and the susceptibility of varieties to infection are all treated at some length.

The perennial mycelium of pear rust, K. VON TUBEUF (*Naturw. Ztschr. Land u. Forstw., 5 (1907), No. 4, pp. 217–219, fig. 1*).—The author figures and describes the appearance of the æcidial stage of pear rust on shoots of trees where the mycelium must have been perennial, as the time of occurrence and location seem to indicate that it had wintered on the host plant.

Oïdium or powdery mildew of the vine, F. T. BIOLETTI (*California Sta. Bul. 186, pp. 315–352, figs. 17*).—A description is given of the Oïdium or powdery mildew of the vine, which is due to the summer or conidial phase of *Uncinula spiralis*. This disease, according to the author, is one of the most serious fungus diseases to which grapes in California are subject.

After describing the fungus and its effect upon the host plant, the author gives accounts of the methods of treatment, the application of sulphur, it is claimed, being the most efficient. Methods of training, cultivation, and irrigation which keep the vine dry minimize the danger of attack. The weather and season when the sulphur is applied are of great importance, and the number of treatments will vary with the locality, season, and variety. The cost of the sulphur and its application will vary from 50 cts. to $2.25 per acre, depending upon the form of apparatus and the fineness of the sulphur. Thus far

American makes of machines have been found inferior to some obtained in Europe, which are especially adapted to the distribution of sulphur.

Rose canker, P. SORAUER (*Ztschr. Pflanzenkrank., 17 (1907), No. 1, pp. 22–32, pls. 2*).—A form of canker observed on Crimson Rambler and other roses which appears as a result of frost injury near the base of the stems is described. A similar injury is also reported upon various spiraeas.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Recent progress in the study of variation, heredity, and evolution, R. H. LOCK (*London: J. Murray, 1906, pp. XV+299, pls. 5, figs. 47*).—In this volume an attempt is made to summarize some of the results of recent investigations bearing upon the subject of heredity for the purpose of indicating, wherever possible, their value to the breeder of animals and plants. Especial attention is given to natural selection, biometry, mutation, Mendelism, and cytology. Examples chosen to illustrate various features of evolution and heredity are drawn both from the plant and animal kingdoms and from the work of recent and also some of the older investigators.

Mammals of the Mexican boundary of the United States, E. A. MEARNS (*U. S. Nat. Mus. Bul. 56, pt. 1, pp. XV+530, pls. 13, figs. 126*).—The biological section attached to the international boundary survey between Mexico and the United States made observations on the mammals and plants of that region. A list is given of the trees observed along the Mexican boundary line together with a general account of the botanical features of this region and the flora. The greater part of the volume (pp. 149–501) is occupied with a detailed discussion of the mammals of the region belonging to the orders Marsupialia, Edentata, Ungulata, and Glires. Particular attention is devoted to the ground squirrels and mice.

Useful birds and their protection, E. H. FORBUSH (*Boston: Mass. Bd. Agr., 1907, pp. XX+437, pls. 56, figs. 171*).—The Massachusetts State Board of Agriculture, in recognition of the economic importance of birds in the control of insect pests, provided an appropriation for the preparation of a volume covering the general habits of birds and their protection. The subject matter is largely based on the facts and conditions observed in Massachusetts, but also applies in large part to other sections of the country.

The subjects discussed in the volume include the general value of birds to man; their utility in orchards, woodlands, fields, and gardens, the natural checks which operate to diminish the multiplication of birds, and practical methods for the protection of all useful birds.

An ornithological cross-section of Illinois in autumn, S. A. FORBES (*Bul. Ill. State Lab. Nat. Hist., 7 (1907), Art. 9, pp. 305–335*).—The purpose of the observations reported in this article was to determine the relative frequency of different species of birds, the feeding habits of which are fairly well known. For this purpose two of the assistants of the author were instructed to travel across the State of Illinois from east to west, noting the species and number of individuals of birds which could be observed within a strip of land 150 ft. wide extending across the State. The area covered by these observations was 3,519 acres, and the total number of birds identified was 4,804, of which 1,620 were English sparrows and 3,184 native species. The observations showed the presence of 874 birds per square mile, or 1.36 per acre.

A number of tables are presented, showing the relative frequency of the 18 most important native birds of Illinois, the number of birds observed in fields of different crops, and the apparent preference of birds for certain crops. It

is believed that after more field work of this sort has been done a reliable basis will be formed for generalizations regarding the actual value of birds to the farmer.

A history of the commission of agricultural parasitology, A. MERAZ (*Bol. Com. Par. Agr., 4 (1907), No. 1, pp. 106, pls. 3*).—The results obtained by the Mexican commission of agricultural parasitology during the past 6 years are summarized in this report with particular reference to the bearing of this work upon the advancement of practical agriculture. Particular mention is made of the work of the commission in the study of injurious insects and fungus diseases.

Entomological notes, W. W. FROGGATT (*Agr. Gaz. N. S. Wales, 18 (1907), No. 2, pp. 149–152*).—Brief notes are given on the bot fly, the elephant beetle on apple trees, and wireworms in pastures.

Report upon the work of the State crop pest commission, W. NEWELL (*Crop Pest Com. La. Circ. 13, pp. 11*).—Brief mention is made of the details of office work, publication of circulars, exhibits at fairs, cooperation with the Bureau of Entomology of this Department, and lectures given by the members of the Louisiana Crop Pest Commission. Attention is being given to nursery inspection, the eradication of the white fly and cattle ticks, and a study of the New Orleans ant. In 1906, the red-pink fungus was introduced into Louisiana orange groves, and despite the dry season which is considered unfavorable to its development, more than 95 per cent of the white flies were destroyed by it.

Insects and diseases liable to be introduced into Mississippi, G. W. HERRICK (*Mississippi Sta. Bul. 96, pp. 16, figs. 9*).—Attention is called to the possibility of introducing into Mississippi the San José scale, new peach scale, woolly aphis, strawberry louse, cotton-boll weevil, black knot, crown gall, and peach rosette. These pests and fungus diseases are briefly described and directions are given for combating them if they should appear.

A natural history of the British lepidoptera, J. W. TUTT (*London: Swan, Sonnenschein & Co.; Berlin: Friedländer & Son, 1906, vol. 5, pp. XIII+558, pls. 6*).—In the first part of this volume a general account is given of hybrids and mongrels among lepidoptera with numerous instances of each and with mention of the laws of heredity observed in these phenomena.

The greater part of the volume is occupied with a detailed account of the group Alucitides, including descriptions of species, analytical tables for identification of species, and biological notes.

The principal animal enemies of wheat, L. VIVARELLI (*Rivista, 4. ser., 13 (1907), Nos. 1, pp. 5–9; 2, pp. 33–37; 3, pp. 56–60; 4, pp. 80–84; 5, pp. 105–108; 6, pp. 129–131; 7, pp. 158–161; 8, pp. 172–174, figs. 3*).—The author presents a general review of the known facts regarding the appearance, biology, and means of combating the more important insect and other enemies of wheat. In this discussion notes are given on cockchafers, wireworms, mole crickets, cutworms, Hessian fly, wheat midge, *Sitophylus granarius*, grain weevil, nematode worms, and certain species of birds.

Thrips, L. P. DE BUSSY (*Meded. Deli-Proefstat. Medan, 1 (1907), No. 5, pp. 172–174*).—A brief report is made of the injury to tobacco as a result of a serious infestation with tobacco thrips. In combating this pest the best results were obtained from the thorough application of kerosene emulsion.

Economic notes on aphids and coccinellids, R. H. JOHNSON (*Ent. News, 18 (1907), No. 5, pp. 171–174*).—In studying lady beetles the author has had occasion to observe plant lice on various native and introduced species of plants, some of which are not commonly reported as being infested with plant lice. It appears that the lady birds which feed upon these plant lice are not found in the same abundance on all of the host plants upon which the plant lice feed.

The apple woolly aphis and remedial measures. Green apple leaf aphis and remedies, R. I. SMITH (*Ga. Bd. Ent. Bul. 23, pp. 48, figs. 10*).—A comparison of various remedies for the woolly aphis showed that kerosene emulsion used at a strength of 15 per cent is most effective. In applying this remedy the soil should be removed to a depth of 2½ to 3 in. around the trunks of trees and the kerosene emulsion applied directly to the soil. For small trees the area thus treated may be 3 ft. in diameter, and for this from 2½ to 3 gal. of kerosene emulsion would be required. For larger trees with roots spreading 3 or 4 ft. in all directions, soil should be removed from a circle of not less than 4 ft. in diameter and from 5 to 6 gal. of emulsion applied. In the case of trees from 4 to 10 years of age this treatment will cost from 4 to 8 cts. per tree. One application is sufficient for a year, and two applications in successive years will practically destroy the woolly aphis.

Less satisfactory results were obtained from the use of tobacco dust, tobacco stems, carbon bisulphid, and whale-oil soap.

The apple leaf aphis may be successfully controlled by spraying with a tobacco decoction prepared by boiling 3 lbs. of tobacco stems in 5 gal. of water for 2 hours or by spraying with a 20 per cent kerosene emulsion.

Results obtained by Berlése and Silvestri in combating the olive fly, CUBONI (*Bol. Quind. Soc. Agr. Ital., 12 (1907), No. 7, pp. 226–231*).—The injuries caused by the olive fly have been successfully combated by the use of a mixture containing 65 parts molasses, 31 of honey, 2 of glycerin, and 2 of arsenate of soda. Before using, this stock mixture is diluted with 10 parts of water.

Fruit fly, J. S. JEFFERSON (*Jour. Dept. Agr. West. Aust., 15 (1907), No. 3, pp. 161–166*).—In combating this pest it is necessary promptly to remove and destroy infested fruit in order to prevent the great multiplication of the fly. Brief notes are given on the distribution of the fly in Western Australia and the probable means by which it is accomplished.

The fruit-tree leaf-roller, J. M. STEDMAN (*Missouri Sta. Bul. 71, pp. 21, figs. 14*).—*Cacœcia argyrospila* fortunately does not occur every year in large numbers. In some cases the damage is excessive to all kinds of orchard trees.

In the experiments carried out by the author it was found that the insect has but one brood annually, that the winter is passed in the egg stage on twigs and small branches, and that the larvæ appear in May and feed upon the young leaves and buds. These larvæ are partly protected by the leaves which they fasten about them, but the thorough application of arsenate of lead just before the blossoms open or just after they have fallen and before the larvæ have completed their leaf nest gives satisfactory results.

The gipsy moth in Maine, E. F. HITCHINGS (*Bul. Maine Dept. Agr., 6 (1907), No. 1, pp. 18, pls. 2, figs. 5*).—A brief historical account is given of the gipsy moth in the United States, and particularly in Maine, together with notes on the habits and life history of the insect. The present status of the moth in Maine is indicated, and a copy is given of the recent State law for the protection of trees and shrubs and of the rules adopted by the commissioner of agriculture in carrying out this law.

Spiders and the nun moth, C. LOOS (*Centbl. Gesam. Forstw., 33 (1907), No. 3, pp. 109–115, fig. 1*).—Observations were made on the effectiveness of spiders in the destruction of the nun moth in its various stages.

Phylloxera in Vatellina, G. MOLON (*Agr. Mod., 13 (1907), No. 11, pp. 156–159, figs. 4*).—The present status of the phylloxera in this region is briefly described with notes on the methods which have been undertaken for its control.

Three enemies of the cacao in Saint Thomas, M. MONTET (*Jour. Agr. Trop., 7 (1907), No. 70, pp. 106–109*).—In the author's opinion the 3 worst enemies of cacao in Saint Thomas are rats, white ants, and an unidentified insect borer.

Rats may be controlled to some extent by the use of infectious virus and poisoned baits and by the mongoose. The nests of white ants are quite easily destroyed by the use of bisulphid of carbon.

Insects in the coniferous forests of Vosges in 1906, DE GAIL (*Rev. Eaux et Forêts, 46 (1907), No. 6, pp. 161–164*).—A careful survey of this region was made to determine the extent of infestation of coniferous trees with various species of bark beetles and weevils. The results are stated in a tabular form. It is believed that in such work frequent reconnaissances are desirable. Trees found to be infested should be immediately cut and the bark removed.

A homemade and effective insect trap, J. D. EVANS (*Canad. Ent., 39 (1907), No. 5, pp. 150–152, fig. 1*).—The author has had excellent success in catching insects for collections from the use of a simple trap. This consists of a paper funnel in which an incandescent light is suspended and which opens below into a glass jar containing cyanid of potash.

A new method of preparing arsenate of lead, L. DEGRULLY (*Prog. Agr. et Vit. (Ed. l'Est), 28 (1907), No. 16, pp. 462, 463*).—On account of his inability to obtain acetate of lead upon the market, the author used nitrate of lead for the preparation of arsenate of lead by combination with arsenate of soda. For this purpose, good results were obtained when 0.5 kg. arsenate of soda in 5 liters of water was added to 1.2 kg. nitrate of lead in 5 liters of water.

Annual report of the Bee-Keepers' Association of the Province of Ontario, 1906 (*Ann. Rpt. Bee-Keepers' Assoc. Ontario, 1906, pp. 64*).—In this report a record is given of the proceedings of the twenty-seventh annual convention of the Ontario Bee-Keepers' Association held in Toronto, November 7–9, 1906. The discussions at the various sessions were largely of a practical nature and concerned chiefly the production and marketing of honey. The essential points in the production of comb honey were discussed by U. H. Bowen (pp. 14–16). The matter of inspection for foul brood received considerable attention, and a copy is given of the Ontario Act for the suppression of this disease.

Short accounts were also presented of beekeeping as an occupation for women, apiary appliances, retailing honey, fall management of bees, etc.

The classification, biology, and distribution of the honeybee, H. VON BUTTELREEPEN (*Mitt. Zool. Mus. Berlin, 3 (1906), No. 2, pp. 117–201, figs. 8*).—The present monograph on the honeybee includes a discussion of the original home of the honeybee and its relatives, the instincts of bees, the systematic relationship of the honeybee and other species, and an elaborate account of the biology of bees. The literature of the subject is discussed in connection with a bibliography of 140 titles. Analytical tables are presented for the identification of varieties of bees related to the honeybee, and descriptions are given of the common races of the honeybee and other species of bees known to be of possible value for the collection of honey.

Rearing queens, E. GIRAUD (*Apiculteur, 51 (1907), No. 4, pp. 157–163, figs. 4*).—A description is given of the form and characters of the natural cell in which queens are reared, and attention is called to the importance of rearing queens at home in order to be sure of the breeding and to save expense. The author describes and illustrates practical methods by which queen cells may be started and the worker bees induced to supply these cells with royal jelly for the development of the queens.

Amount of water necessary for bees, G. GENDOT (*Apiculteur, 51 (1907), No. 4, pp. 164–168*).—Statistical data are presented relating to the quantity of water required by bees under various conditions. According to the observation of the author and other investigators, it appears that bees need from $\frac{1}{5}$ to $\frac{1}{2}$ kg. of water daily per colony. It is desirable, therefore, that attention be given to

this point so that the bees may have an adequate supply of pure water conveniently located.

Disinfection of silkworm nurseries by means of a new method, GASPERINI (*Bol. Quind. Soc. Agr. Ital., 12 (1907), No. 7, pp. 292–294*).—In outbreaks of flaccidity among silkworms, the author obtained excellent results in controlling the disease by fumigating with a mixture of nitrate of potash and sulphur, allowing the fumes to operate for 24 hours.

FOODS—HUMAN NUTRITION.

Twenty-first annual report of the Ohio dairy and food commissioner, H. ANKENEY (*Ann. Rpt. Ohio Dairy and Food Comr., 21 (1906), pp. 98*).—The work of the State dairy and food commission with reference to the examination of foods and drugs, the legal prosecutions resulting from the work, the financial report for the year, and several special reports are included in this publication, as well as a summary of the State food laws. Of the 1,964 samples examined, 834 were found to be adulterated. As a result of the work prosecutions were brought during the year on 121 articles.

An examination of canned chicken, veal loaf, and similar goods showed that the greater number of these samples had to be classed as adulterated. "The chicken and turkey samples were chiefly other meats. Some of the samples contained tin and zinc, which was evidently due to the poor quality of the containers or lack of care in canning. A few contained either boric, benzoic, or salicylic acid, while perhaps half contained sulphites reported by chemist as traces only or as added sulphites."

Corn oil; its possible use as an adulterant in lard and its detection, W. McPherson and W. A. Ruth (pp. 18–23).—Maize oil, or corn oil, a by-product in the manufacture of starch and glucose, was the subject of special investigation, as the material is attracting attention as a food stuff and is rumored to be used as an adulterant for culinary fats. To determine the effects of the presence of corn oil in lard, 3 samples of pure lard were mixed with definite quantities of the oil and tested for making different sorts of pastry, etc., under the auspices of the domestic science department of the Ohio State University. Judged by quality and appearance, the presence of corn oil did not appreciably affect the quality and palatability of the food in which it was used. "No physiological tests were carried out, but considering the source of the oil and its similarity to wholesome vegetable oils, there can be little doubt as to its food value. Whether corn oil is actually used as an adulterant of lard or not, the above results show that lard containing as high as 10 per cent of the oil might easily pass for the pure product."

The chemical and physical characteristics of lard, corn oil, and mixtures of the two were studied with a view to finding a satisfactory method for detecting the presence of corn oil, but neither the iodin number, the butyro-refractometer readings, nor color tests gave satisfactory results. The best results were obtained by separating the unsaponifiable product according to Bömer's acetate method. "The percentage of sitosterol in corn oil is much larger than the percentage of cholesterol in lard, and this fact, together with the fact that the melting points of the acetyl derivatives of the cholesterol and sistosterol are so far apart (113° and 127°–128°, respectively), renders it possible to detect even very small amounts of corn oil present in lard."

"It is a noteworthy fact that the melting point of the acetyl derivative obtained from the lard containing even 2 per cent of corn oil is markedly higher than the corresponding derivative obtained from pure lard. This would indicate that in the process of purification the sitosterol is obtained nearly pure."

The method outlined "would, of course, fail in the presence of cotton-seed oil. It is doubtful, however, whether the latter oil is used to any extent as an adulterant of lard at present, due undoubtedly to the ease with which it can be detected. In the examination of a large number of commercial samples of lard made during the last three years in this laboratory not a single sample was found adulterated with cotton-seed oil.

"The large amount of ether necessary for the extraction of the unsaponifiable products . . . renders it an expensive . . . [method] to carry out. The ether, however, may be largely recovered by distillation. An investigation is now being carried out in this laboratory with the hope of so modifying the method as to overcome the above objection."

Sulphurous acid in meats, O. S. Marckworth (pp. 29–39, dgms. 2).—Methods for determining the presence of sulphurous acid in meat were studied with samples of pork and beef with special reference to the determination of the amount of sulphur which may be normally present as a result of decomposition.

"For the recovery of sulphurous acid in meats, at least, iodin should not be used as an absorbent when it is to be determined volumetrically or gravimetrically. The results are most erratic and unreliable. On the other hand bromin water is efficient and reliable. There does not seem to be much ground for the assertion that too much sulphurous acid is indicated by the use of bromin as an oxidant. The quantities found in fresh, uncontaminated samples of both pork and beef are so small as to be negligible when calculated to SO_2. (This may not apply to meats long refrigerated or canned.)

"The amount of volatile sulphur compounds will probably furnish a check on the age of meats, whether fresh, refrigerated, or canned.

"The cause of the [observed] difference in the amount of SO_2 recovered from pork and beef must be left for continued study. It is no doubt partially explained by the difference in the amount of fat in the respective samples.

"It is my opinion that fresh meats should be condemned when showing more than 0.0025 per cent sulphur calculated to SO_2 for when showing this amount they have already become more or less disintegrated by bacteriological action. Any amount above 0.0025 per cent must either be attributed to excessive age or added sulphites."

The pure food and drug laws of the State of Indiana (*Indianapolis: Ind. Bd. Health, 1907, pp. 64*).—Provisions of the State laws which have to do with foods and drugs are given and an index is provided. The regulations regarding sanitary conditions take into account the health of employees in dairies, bakeries, etc., and the condition of abattoirs and slaughterhouses, groceries and meat markets, drug stores, hotels, and restaurants.

Report of committee on adulterations of foods, seeds, and other products, and legislative enactment recommended, S. B. Packard, H. R. Wright, and C. F. Curtiss (*Des Moines: Iowa Dept. Agr., 1906, pp. 41*).—Data regarding the composition of concentrated feeds and condimental feeds have been noted from publications of the Iowa Experiment Station (E. S. R., 18, p. 966).

Proteids in the peanut seed, M. Soave (*Ann. R. Accad. Agr. Torino, 48 (1905), p. 1; abs. in Zentbl. Physiol., 20 (1906), No. 23, p. 773*).—A proteid with diastatic properties was isolated, as well as two proteids soluble respectively in sodium-chlorid solution and a dilute alkaline solution. These soluble proteids on hydrolysis yielded different amounts of histidin and arginin, and so may be regarded as different bodies. No alcohol soluble proteid resembling zein was found.

Oil-bearing seeds (*Transvaal Agr. Jour., 5 (1907), No. 18, pp. 411, 412*).—A note reporting analyses of "Marula" nuts and "Maraamas" beans. The latter plant is not identified botanically.

Concerning a little-known edible mushroom, A. R. CHIAPPELLA (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 7, pp. 384–389*).—Descriptive and analytical data regarding an edible mushroom (*Boletus bellini*) are reported and discussed.

The identification of schi fruit and illipe fruit and their products, E. SCHAFFNIT (*Landw. Vers. Stat., 65 (1907), No. 5–6, pp. 449–456, pl. 1*).—The manufacture of culinary fats from the fruits of *Butyrospermum parkii* and illipe species is described. The residue from fat extraction is used to some extent as a feeding stuff and as an adulterant for concentrated feeds. The microscopic structure of these materials is described with a view to their identification.

Concerning the ash content of paprika, R. WINDISCH (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 7, pp. 389–397*).—The results of studies of the ash content of a number of sorts of paprika are discussed with reference to the use of such data for the detection of adulteration. According to the author, an ash content of 7 to 8 per cent is not proof that paprika is adulterated, provided a careful study of other characteristics or constituents indicate that it may be pure.

Concerning edible earths, BALLAND (*Jour. Pharm. et Chim., 6. ser., 23 (1906), pp. 181–183; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 7, p. 433*).—As analyses show, so-called edible earths contain no nutritive material.

Lead and arsenic in tartaric acid, citric acid, and cream of tartar, A. W. J. MACFADDEN (*Local Govt. Bd. [Gt. Brit.], Med. Dept., Rpts. Insp. Foods, 1907, No. 2, pp. 10*).—With a view to obtaining data for standards of purity a large number of samples of tartaric acid and cream of tartar were examined. Small quantities of lead were found in nearly every sample and very small quantities or traces of arsenic in a number of samples, these metals being accidental impurities.

"Lead and arsenic are two substances in which the deleterious effect of continued ingestion of small doses has been clearly shown. It should be the aim of the manufacturer to exclude both these substances from articles of food and food ingredients. Looking to all the circumstances, however, and having in view the quantities in which tartaric and citric acids and cream of tartar are consumed in food, drinks, medicines, etc., it is reasonable to conclude that minute amounts of lead or arsenic (arsenious oxid) below 0.002 per cent and 0.00014 per cent, respectively, would not be sufficient to justify their condemnation."

Concerning the water content of cooked sausage, H. LÜHRIG and A. SARTORI (*Pharm. Centralhalle, 48 (1907), No. 14, pp. 265–268*).—The data here given include determinations of the water content of small sausages known as Vienna sausage or Frankfort sausage, before and after smoking, after the short cooking in hot water which the sausage receives at the factory and after the further cooking to which they are usually submitted before they are eaten. The work was undertaken with a view to securing data for use in the prevention of an undue water content when sold.

The preservation of eggs by water glass and the composition of the preserved eggs, J. HENDRICK (*Jour. Agr. Sci., 2 (1907), No. 1, pp. 100–105*).—The examination of a large number of eggs preserved in trade lots in large tubs showed that a few were bad or unsalable. For instance, out of 384 dozen eggs examined 5 dozen, or 1.3 per cent, were bad, the great majority being broken or cracked eggs. The eggs preserved in water glass were usually of good quality and could hardly be distinguished in appearance, flavor, and smell, either raw or cooked, from so-called fresh eggs—that is, eggs a few days old. As the

period of preservation increases a distinct change is noted both by the eye and palate. Eggs which have been 3 or 4 years in water glass are easily recognized, the white becoming pink in color and very limpid. "The slight alteration in the flavor of the egg and in the liquidness of the white may be due to the increase in soda." Even when 4 years old no unpleasant taste or smell was observed and the white coagulated in the usual manner when cooked. There was a slight characteristic odor which did not suggest sulphureted hydrogen. "The changes in the preserved eggs take place very gradually. At 1 year old they are hardly noticeable; at 2 years they are distinct, but not so distinct as at 3 or 4 years old."

To summarize the data gained from general observations a number of experiments were made in which fresh eggs and eggs preserved for different lengths of time were compared, the principal results being as follows:

Composition of fresh and preserved eggs.

Kind of egg.	Water.	Nitrogen.	Fat.	Ash.	Potash.	Soda.	Silica.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Fresh eggs	73.18	2.11	10.40	1.02	0.120	0.194	0.010
Eggs preserved 1 year	73.55	2.01	10.70	.93	.101	.215	.022
Eggs preserved 2 years	73.73	2.07	10.41	1.02	.073	.311	.039
Eggs preserved 2 years	72.12	2.17	11.19	0.92	.075	.296	.023
Eggs preserved 3 years	74.66	2.10	9.42	1.00	.069	.343	.019

In general, "there is practically no change in the composition of eggs even from lengthened immersion in water glass. Practically no silica and very little, if any, soda find their way into the eggs."

To determine whether much silica was deposited in the shells of preserved eggs the shell and adhering membrane of a number of samples were analyzed. "If we omit the different quantities of organic matter adhering to the shells, the main difference between the different samples is in the amount of silica which they contain. In the fresh eggs this is about 0.5 per cent, and it increases according to the length of time the eggs have been in the solution. In the eggs which were 3 years in the solution the silica amounts to nearly 2.5 per cent. It appears, then, that a slow deposition of silica takes place in the shell of the egg. The percentage of lime in the shells remains practically constant. This deposition of silica in the shells probably blocks up the pores of the shells to some extent and renders them less permeable."

Analyses of the sodium silicate used for the preservation of eggs showed that it "does not contain quite sufficient soda to form the acid metasilicate, $NaHSiO_3$. The solution given by the water glass is strongly alkaline in reaction."

A sample of sirup-thick water glass contained 37.91 per cent silica, 16.48 per cent soda, and 0.14 per cent potash, and a solution prepared for preserving eggs 2.76 per cent silica, 1.20 per cent soda, and 0.01 per cent potash.

Influence of temperature and atmospheric moisture on the preservation of eggs, De Loverdo (*Compt. Rend. Acad. Sci. [Paris], 144 (1907), pp. 41–43*).—Fresh eggs, it was found, could be preserved for months in the cold without loss in weight or any apparent change, provided the temperature was kept at −1° C. and the moisture content of the air at 78°. If the temperature is lower than −1.5° C. the eggs freeze, while if the air is more moist they will mold.

Chemical composition of oyster liquor, J. Baylac (*Compt. Rend. Soc. Biol. [Paris], 62 (1907), No. 6, pp. 250–252*).—Analyses of the liquor of oysters from the Mediterranean and from the ocean, which are reported in full, showed that the composition of the liquor of each variety is relatively constant as regards

albumin (about 2 gm. per liter being present), urea, ammonium salts, phosphates, sulphates, chlorids, potassium, silica, etc. The Mediterranean oyster liquor contained a larger quantity of organic material than that of oysters from the ocean.

Experiments on the metabolism of matter and energy in the human body, 1903–1904, F. G. Benedict and R. D. Milner (*U. S. Dept. Agr., Office Expt. Stas. Bul. 175, pp. 335, pls. 2, figs. 4*).—Like the experiments reported in earlier bulletins (E. S. R., 15, p. 698) those here described furnish important data regarding the transformations of matter and energy in the body, the demands of the body for nutriment, the effect of muscular work upon such demands, and the actual nutritive values of the different kinds of food materials and their ingredients. These experiments differ materially from those previously reported, however, in that the respiration calorimeter with which they were made has undergone an important modification which permits the direct measurement of the amount of oxygen consumed by the subject, thus affording a more complete balance of income and outgo of matter and energy than has ever been possible hitherto.

The account of the experiments is preceded by a description of the respiration calorimeter in its present form. As modified, the apparatus is of the closed-circuit type, the respiratory products (carbon dioxid and water vapor) being removed and fresh oxygen supplied to the continuous ventilating air current.

Among the questions discussed on the basis of experimental data are the digestibility of food, the metabolism of nitrogen and protein, the elimination of carbon dioxid and water, heat production, bodily activity and the measurement of muscular work, fats versus carbohydrates as protectors of protein, protein as a source of energy for muscular work, the relative efficiency of fats and carbohydrates in rations for muscular work, the conservation of energy in the body, and problems of ventilation.

As regards the theory that protein is the source of muscular work the results of the investigations reported indicate that with all due allowance for any delay in the excretion of nitrogen resulting from the katabolism of protein induced by severe muscular work, the total probable disintegration is still far from sufficient to supply all the energy for external muscular work.

As regards the relative efficiency of fats and carbohydrates in rations for muscular work the results, in the authors' opinion, "seem to warrant the belief that fats are possibly slightly inferior to carbohydrates as sources of energy for muscular work."

The following deductions the authors consider justified from the data supplied regarding ventilation: "An increase in the amount of carbon dioxid present in the air is absolutely without effect on the mental and bodily comfort of the subjects of the experiments. These subjective observations are paralleled by observations on the respiratory exchange and heat output, neither of which factors is in any way affected. The so-called *concomitant* impurities of the earlier writers were not discovered in this research. The subjects at no time complained of headache or other discomfort. It is conceivable, to be sure, that the impurities from one individual would have no deleterious effect upon the same individual, but might have on another; yet the water condensed from the respired air, which would probably contain large proportions of such impurities if there had been any, when injected into white rats showed no indication whatever of any virulent toxic poison; and . . . [it seems probable] that the unusual control of thermometric and hygrometric conditions of this form of respiration calorimeter precludes conditions of temperature and humidity ordinarily present in poorly ventilated rooms."

The functions of food in the body, A. RABAGLIAT (*London: Elliot Stock, 1907, pp. 46; rev. in Brit. Med. Jour., 1907, No. 2419, p. 1125*).—In this discussion of body dynamics the author advances the theory that the body secures its energy during sleep, though he admits that the ultimate source of vital energy is not known. In his opinion, energy is not derived from food and he believes that man eats too much.

A graphic method in practical dietetics, I. FISHER (*Jour. Amer. Med. Assoc., 48 (1907), No. 16, pp. 1316–1325, figs. 15*).—The data reported in this description of a method and apparatus for determining food values have been noted from another publication (E. S. R., 17, p. 1174).

Biological energetics. The greater expenditure of energy pertaining to a meat diet in comparison with the expenditure which occurs when food materials containing all 3 nutrients are consumed, A. CHAVEAU (*Compt. Rend. Acad. Sci.* [*Paris*], *144 (1907), No. 4, pp. 173–178, fig. 1*).—Experiments were made with dogs at rest and performing a known amount of work to determine the relations existing between the nature of the nutrients and the activity of the respiratory exchanges taken as an indication of the expenditure of energy occurring in connection with their assimilation. There were experiments with no food as a basis of comparison and others with a uniform basal quantity of meat supplemented by equivalent quantities of sugar, fat, and meat.

According to the author, the results of both the rest and the work experiments agree in showing that the utilization of the nutrients by the organism, that is, their digestion, absorption, and assimilation, entails an increased consumption of oxygen, indicative of an increase in the energy expenditure of the organism, the increase being slight in the case of the carbohydrates, somewhat greater in the case of fat, and very decidedly larger in the case of the proteids. The author states that there is no indication that this extra energy metabolism is due to increased internal activity of the organism and he believes that the cause, whatever it may be, is not in accord with the principle of isodynamism.

Concerning the rapidity of protein cleavage in the animal body, W. FALTA (*Deut. Arch. Klin. Med., 36 (1906), pp. 517–564; abs. in Zentbl. Gesam. Physiol. u. Path. Stoffwechsels, n. ser., 2 (1907), No. 1, p. 29*).—According to the author's observations, the cleavage of large quantities of pure proteids in the body does not progress as rapidly as has been supposed, 3 or 4 days being required for the excretion of all the nitrogen derived from even those which are easily broken down. The rapidity of cleavage differs with various proteids, and the proteids studied may be arranged according to this property in the following groups: (1) Gelatin, casein, serum albumin and fibrin, (2) blood globin, (3) hemoglobin, and (4) ovovitellin and genuine ovalbumin. Nitrogen retention and similar questions are discussed.

Concerning the digestibility of fat in the animal body, S. LEVITES (*Ztschr. Physiol. Chem., 49 (1906), No. 2–3, pp. 273–285*).—Experiments on the digestibility of butter fat, beef suet, and lard led to the following conclusions:

The digestibility of fat involves two chemical processes, namely, the cleavage of the fat into fatty acids and glycerin and the formation of salts of the fatty acids. Neither of these processes is carried on to completion since the condition of equilibrium is always reached between neutral fat and fatty acids or neutral fat and fatty acids and their salts. In the stomach fat undergoes only a little chemical change (saponification) so long as the liquid from the duodenum does not pass into the stomach. When this takes place the fat cleavage is considerable. Fat is not resorbed in the stomach. Resorption takes place first in the upper part of the small intestine, either in the form of free fat or free fatty acid, but further investigations are needed before the form in which fat is resorbed can be stated.

A parallelism may be noted between fat cleavage (saponification) and fat resorption, and the greater the cleavage the greater the resorption. Fat without the addition of other food stuffs is well assimilated by the body, the proportion resorbed being about 96 per cent in the case of butter and beef fat. Lard is somewhat less thoroughly assimilated, probably owing to its laxative properties.

The experiments reported were made with dogs having operative fistulæ.

The effect of training upon the muscular power with isometric work, A. F. Hellsten (*Skand. Arch. Physiol., 19 (1907), No. 1–3, pp. 218–230*).—From investigations with young men in training for a boat race, the author concludes that in order to obtain the maximum effort from a muscle or group of muscles the power of coordination must be developed. The relation of this power to fatigue and related matters are spoken of. Fatigue manifests itself more slowly with trained than with untrained muscles.

ANIMAL PRODUCTION.

Feeding stuff inspection, C. D. Woods and J. M. Bartlett (*Maine Sta. Bul. 142, pp. 93–114*).—The feeding stuffs examined under the provisions of the State law included cotton-seed meal, cotton-seed feed, linseed meal, gluten feed and meal, distillers' grains, brewers' grains, alfalfa meal, proprietary feeds, molasses and sugar feeds, corn and oat feeds, oat feeds, hominy feeds, miscellaneous starchy feeds, wheat offals, and beef scraps. Most of the feeding stuffs met, or very nearly met, their guarantee.

"The cotton-seed meal situation has been a very unfortunate one in Maine the present year. In the late fall the cotton crop was very seriously damaged by a storm which resulted in a smaller yield of cotton seed than was anticipated, and also made considerable dark-colored meal. This shortage materially advanced the price of choice cotton-seed meal and increased the quantity of meal that was below prime in quality."

Many feeding stuffs composed of refuse from milling oats, corn, etc., are on the market. "For the most part these goods are fairly well up to their guarantee and no fault can be found with the manufacturer for desiring to sell these waste products. Few or no claims are made for nutrients which the goods do not actually carry."

Though many of the corn and oat feeds meet their guarantee this was not the case with some of the corn and oat feeds and mixed feeds. "There is no class of feeding stuffs in which the consumer needs to use greater care at present than in the purchase of mixed feeds. While the regular brands are all right, as they have been in the past, there are some spurious articles in the market." Apparently fraud was intended with only one brand of wheat offals.

As regards beef scraps it was pointed out that the guarantee placed on the goods is in some instances at least only a very general guide to their actual composition.

Stall feeding versus grazing, A. M. Soule and J. R. Fain (*Virginia Sta. Bul. 164, pp. 51–88, figs. 11*).—Tests were made to compare the cost and possible profits of fattening cattle in stalls with feeding a low grain ration through the winter in stalls and finishing on grass.

In the test with stall-fed cattle, which covered 180 days, 6 lots of 8 steers each were used. It was also a part of the plan to study the comparative value of different corn products when fed with cotton-seed meal and so the grain ration, which averaged 6.7 lbs. per head per day at the beginning of the test, was made up of ear corn, split corn, fine corn-and-cob meal, and coarse corn-and-cob meal each with cotton-seed meal 1 : 1, and shelled corn and corn meal each with cotton-seed meal about 2 : 3. The coarse fodder in every case consisted of corn silage, hay, and corn stover. As the test progressed the amount of grain and

the proportion of corn were increased, but the grain never exceeded 12.5 lbs. per head per day.

The gains ranged from 1.29 lbs. per head per day on the split corn and cotton-seed meal ration to 1.74 lbs. on corn meal with cotton-seed meal. Considering the average values the gain on the whole corn rations was 1.42 lbs. per head per day and on the corn meal of different sorts 1.52 lbs. As regards the feed eaten per pound of gain the highest values 7.46 lbs. grain and 20.02 lbs. coarse fodder, were noted with the split corn ration and the lowest values, 5.52 lbs. grain and 15.23 lbs. coarse fodder, with the corn meal ration.

Pigs followed each lot of cattle fed a ration containing whole corn, the number per lot being 2 at the beginning and 4 at the close of the test. The best gain, 0.78 lb. per head per day, was made on shelled corn and the smallest gain 0.6 lb., by the animals following steers fed split corn.

"Though 3.25 lbs. of cotton-seed meal were fed per head per day during the entire feeding period of 180 days, in only one instance did the hogs following show any evidence of ill health. Of the 12 hogs following the cattle, 1 died suddenly, but the cause could not be determined.

"The hogs following the groups receiving whole corn made 937 lbs. of pork, which, at 5 cts., was worth $46.85 or $1.95 per steer. This gave the groups receiving whole corn a material advantage over those fed ground corn.

"These results indicate that cattle can not be fed in the stall under a margin of 75 cts. where they are charged the full market price for all the foodstuffs fed. On the basis of the actual cost of the foodstuffs on the farm, they could often be fed on a margin of 50 cts. and still give the farmer a fair profit on his operations."

The possible profits from feeding cattle in stalls are discussed on the basis of different margins, and in the authors' judgment it would be comparatively easy under good management to feed beef cattle on a margin of 1 per cent profit on the basis of the gains and food cost indicated in this report. Where larger gains are obtained and the food is secured at a lower cost the profits would be correspondingly greater.

In the second test 4 lots of 9 steers each were fed in stalls for 161 days a low grain ration, 2 lbs. per head per day, made up of corn-and-cob meal and cotton-seed meal 1:1, and supplemented respectively by hay, corn stover, corn silage, and a mixture of the silage and stover 1:1, and then pastured for 138 days, the range being at the rate of 5 acres per steer.

While in stalls the average gain per head per day varied from 0.12 lb. with the stover-fed lot to 0.85 lb. on silage. On pasture the smallest gain, 1.67 lbs. per head per day, was noted with the lot which had been fed a mixture of silage and stover and the greatest gain, 2.2 lbs., with the hay-fed lot. Considering the test as a whole, the smallest gain, 1.05 lbs., was noted with the stover lot and the greatest gain, 1.26 lbs., with the silage lot. The gain was least expensive, when the whole test was considered, with the silage-fed lot, costing 4.12 cts., and greatest with the hay-fed lot, being 6.64 cts. per pound, values which are about half of those noted with the stall-fed cattle in the first test.

A special object of the investigation was to compare silage and stover, and a slaughter test showed that the average dressed weight of the silage-fed cattle was 57.07 per cent and that of the stover-fed cattle 56.3 per cent of the live weight. Though the percentage difference was small the extra amount of beef produced on the silage ration, according to the authors' calculation, was 316 lbs., which, at 8 cts. per pound, would make $25.28, or about 25 cts. per 100 lbs. live weight, in favor of the silage ration.

"From the results it appears that the cattle receiving silage as their sole roughness during the winter made the largest average gains, did not drift

materially when turned on grass after the first 10 days, slaughtered out to better advantage than the dry-fed cattle, and were in a thriftier and better condition throughout the entire feeding period. This is sufficient proof of the fact that succulent foods can be fed to cattle maintained as stockers and finished on grass. . . .

"Cattle can be handled advantageously as stockers and finished on grass on a margin of 25 cts. where silage or stover or other inexpensive forms of roughness are used during the winter. Mixed hay proved so expensive that there was a loss with it on a margin of 50 cts.

"The cost of a pound of gain with the stall-fed cattle varied from 7.33 to 9.01 cts.; with the stocker cattle from 4.12 to 6.64 cts. It cost . . . nearly twice as much to make a pound of gain in the stall as where the animals were finished on grass. . . .

"The beef made per acre by the grazers varied from 46 to 60 lbs., or a return of from $2.12 to $2.82 per acre. An acre in silage yielding 8 tons will provide roughness for 4 animals for 180 days, which shows the importance of the silo where intensive farming is practiced, and the fact that larger returns can be secured from the land through the medium of the silo than were obtained through grazing in these experiments. . . .

"The deductions to be drawn from the experiments with feeders are as follows: Feed a small grain ration—not over 2 lbs. per head per day to commence with, and increase it gradually until the cattle are ultimately consuming 15 lbs. per head per day. A liberal ration of silage should be fed throughout the test, decreasing the amount consumed toward the close of the feeding period. Only a minimum amount, not over 2 to 4 lbs., of stover or other dry inexpensive forms of roughness need be fed.

"It would appear that silage may constitute the chief source of roughness for stockers; that a grain ration of 2 lbs. per head per day is sufficient to insure their making substantial and profitable gains during the winter; that the best results will be obtained when the ration consists of equal parts of corn-and-cob meal and cotton-seed meal or some other food rich in protein.

"The feeding value of silage is in a large measure due to its comparative richness in nutrients especially suited for the nourishment of cattle, its ease of digestion as compared with dry foods, its palatability due to its aroma and succulence, and the fact that it aids in cooling the system and keeping it free of effete material and keeping the circulation active."

Baby beef, E. G. Ritzmann (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1905, pp. 181–212, pls. 2, figs. 3; Circ. 105, pp. 34, figs. 6*).—The feeding, care, and management of cattle to produce early maturity—i. e., baby beef—are discussed as well as the present condition of the industry in the United States and similar topics.

"Baby beef is a special article in which the essential characteristics are early maturity, quality, finish, and thickness of flesh. Nine out of ten yearlings sent to market for slaughter do not class as baby beef, because they lack finish or quality, while some are overfed or 'overdone.' This results from lack of a proper understanding of the qualities that constitute the condition known as ripeness or 'finish.' . . .

"Maturity for the block in beef cattle means that condition when they have reached full growth of body and are thoroughly fat or ripe for slaughter. The average age at which cattle are now fully grown and fattened for the market is between 2 and 3 years. Early maturity, therefore, means that the animal has been fully grown and fattened in less than the average length of time required by that class of stock. . . .

"When early maturity is attempted by means of liberal feeding with nutritious

feed, carbonaceous in character and lacking in bulk, the tendency to produce flesh and fat is readily developed; but owing to the smaller proportion of nitrogenous constituents contained in such feed and its lack of bulk the animal's frame does not make a proportionate development, and its natural growth is checked at the expense of the development of flesh and fat. Consequently a slight reduction in size and greater fineness of bone are generally associated with early maturity.

"When very heavy feeding is resorted to there is always the danger of overfeeding, which often results in permanent injury to the animal."

Before weaning, whole milk is the best feed for calves, though good results may be obtained with skim milk if the whole milk is not available.

"Calves fed on skim milk tend to grow in frame rather than to fatten, although their gains may be as rapid as the gains made by calves fed on whole milk. The use of skim milk in producing baby beef therefore lengthens the period of production. . . .

"The method of feeding adopted [after weaning] . . . will depend largely upon the nature of the feeds available and the season of the year. Previous to weaning the ration consists of whole milk supplemented by grain, or skim milk with a small amount of flaxseed jelly, or some other substitute to take the place of butter fat in addition to grain. Corn with milk produces an excellent balance of heat, fat, and muscle-producing feed. After weaning the protein of the milk must be restored by some other feed, although a relatively smaller proportion of it becomes necessary as the calf grows older.

"In the summer time the best combination to furnish the proper balance is a good pasture (bluegrass is preferred for pasture, because it is firm and contains a large percentage of nutrients) and shelled corn or a little oats, if they are cheap enough. Occasionally a little cotton-seed meal, gluten meal, linseed meal, or bran may help to balance the ration and tend to stimulate the appetite. . . .

"Some of the most successful feeders of baby beef have used silage (from 15 to 25 lbs. daily) with good results in a ration consisting of about 3 lbs. corn meal, 2 lbs. wheat bran, and plenty of clover hay. In such a ration the silage will add the succulence, but if silage is not available a small quantity of roots will answer the same purpose. . . .

"Of all the fodders good clover and alfalfa hay have no equal, as they will supply the protein or muscle-making properties that must otherwise be supplied in the form of nitrogenous commercial products, which generally prove very expensive. If the roughness consists largely of such feeds as corn fodder, oat hay, timothy hay, or prairie hay, then some nitrogenous concentrate should be added to give the proper balance.

"Under present conditions the market does not discriminate between steers and heifers for baby beef, as the latter sell for equally high prices as the steers, provided they are equally well finished.

"Some of the principal advantages derived from the production of baby beef as compared with older beef are (1) the quick returns on the investment, (2) the greater demand for the product, and (3) the greater amount of meat produced per pound of feed consumed.

"In feeding baby beef the profit comes in within two years after birth of the calf. In case, also, of the loss of an animal this would be considerably smaller in a young animal, because the latter represents a smaller bulk and has, moreover, been produced at less cost per pound of live weight. On the other hand, the lighter the animals are marketed the more breeding stock is necessary to produce an equal amount of marketable beef. The extra cost of keeping this additional number of breeding stock, however, is offset by doing away with the

cost of keeping steers the third year; thus the number of marketable stock kept on the farm is increased."

Welsh black cattle, J. ROBERTS (*U. S. Dept. Agr., Bur. Anim. Indus, Rpt. 1905, pp. 161–180, pls. 5; Circ. 104, pp. 29, pls. 5*).—The Welsh breed of cattle is considered to be very valuable in Great Britain. The cows are good milkers but the breed is chiefly famous for its feeding qualities and the admitted excellence of the carcass. The author has summarized data regarding the origin and history, characteristics, feeding and management of Welsh cattle, prices of pedigreed stock, and similar topics.

"Welsh cattle are sometimes criticized on the score of late maturity. They probably were somewhat slow feeders in the past, but the adherents of the improved breed claim it is now in the front rank of rapid fatteners. . . .

"The Welsh is not one of the so-called 'fashionable' breeds; consequently pure-bred animals of good quality can generally be bought for much less than the prices paid for well-bred specimens of such breeds as the Shorthorn, Hereford, or Aberdeen-Angus."

Sheep feeding, F. W. WILSON (*Arizona Sta. Rpt. 1906, pp. 152, 153*).—Alfalfa and barley hay, alone, mixed, and supplemented by oat hay were compared with 4 lots of 10 sheep each.

In the 38 days of the test there was a loss of 2.5 lbs. per lot on the barley hay ration, and gains of 27.5 lbs. on alfalfa and barley hay, 35 lbs. on alfalfa, barley hay, and oat hay, and 140 lbs. on alfalfa hay alone. In the case of the last mentioned lots, the feed eaten per pound of gain ranged from 6.96 lbs. on alfalfa hay alone to 27.09 lbs. on alfalfa and barley hay. The greatest range in cost of a pound of gain was also noted with these lots, being 3.1 cts. and 12.2 cts., respectively.

"Alfalfa hay seems to be more palatable to sheep than barley hay or oat hay. This was clearly shown in the lots receiving alfalfa as a part of the ration. The sheep picked out a greater portion of the alfalfa and ate it before eating the balance of the ration.

"Oat hay seems more palatable to them than barley hay. The beards from barley roll up between the teeth and the jaw, causing irritation. The lots receiving barley as a part of the ration were troubled a great deal and had to have the beards removed."

The results are in accord with those reported with steers in an earlier publication of the station (E. S. R., 17, p. 278).

Sheep breeding, F. W. WILSON (*Arizona Sta. Rpt. 1906, pp. 153–155*).—Brief statements are made regarding the progress of breeding tests using native ewes and a Tunis buck.

Sweet clover in San Luis Valley, C. A. LYMAN (*Breeder's Gaz., 51 (1907), No. 17, p. 961*).—Sweet clover, according to the author, when young and tender, is an excellent pasture plant for pigs. It should be cut when 6 in. high, as if allowed to grow older it becomes tough and bitter, so that stock will not eat it.

Government encouragement of imported breeds of horses, G. M. ROMMEL (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1905, pp. 147–159*).—The effect of the present tariff and similar topics are discussed with special reference to the acknowledged needs of the establishment of breeds of horses in this country, particularly draft horses.

"The complete withdrawal of the duty-free privilege, without the present restrictions regarding pedigree and registration, would be undesirable, for the reason that short-bred animals recorded in European books of record would not be kept out. As it is at present, the importer does not bring in such

animals, the duty preventing him, although he could do so if he wished by paying the duty and thus avoiding the scrutiny of his pedigree certificates.

"A more reasonable plan, which has much of merit, is that a duty be placed on males, the importation of females of approved pedigree being permitted without duty. This would give a very desirable impetus to the importation of mares. If this plan were adopted, it would seem desirable to require the importer to state whether his animals were intended for breeding purposes and to have the present pedigree restrictions apply to breeding males as well as females."

Poultry management, G. A. BELL (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1905, pp. 213–266, pls. 5, figs. 7*).—A summary and discussion of data on poultry feeding, including such topics as the classification of fowls, the selection of varieties, houses, and inclosures, the equipment of poultry houses, the management of hens for egg production, raising chickens, broilers, roasters, and capons, fattening poultry, feeding, care, and management under different conditions, marketing poultry and poultry products, preserving eggs, and the diseases of poultry.

Capons and caponizing, R. R. SLOCUM (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1905, pp. 267–275, pl. 1, figs. 6; Circ. 107, pp. 10, figs. 8*).—The selection of breeds, time for caponizing, instruments used, methods of operating, care after the operation, feeding capons, killing and dressing for market, and similar topics are discussed in this general summary of data on the subject.

Cold storage poultry fallacies exploded, H. A. HIGLEY (*Food Law Bul., 2 (1907), Nos. 1, pp. 6–8; 2, pp. 21–23*).—The author differs from the majority who have studied the question with reference to the effects of storing poultry undrawn, and, in addition to discussing the reports of previous investigations on this subject, briefly states the results of his own investigations. His conclusion follows:

"All bacteriological evidence conclusively proves that the edible portions of healthy, dead, undrawn poultry and game do not contain any bacteria, toxins, or ptomaines that are harmful when eaten by man so long as such poultry is kept free from putrefaction. . . . Poultry that goes into cold storage in good bacterial condition comes out in exactly the same condition that it went in, so long as the temperature of the poultry is kept low enough to prevent the growth of putrefactive bacteria, and finally that the longer poultry remains frozen the less bacteria does it contain."

Annual production of animals for food and per capita consumption of meat in the United States, J. ROBERTS (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1905, pp. 277–290*).—A summary and discussion of statistical data.

According to the author's calculations the total per capita consumption of meat in the United States for the year 1900 was 178.75 lbs., beef contributing 78.71 lbs., veal 3.35 lbs., pork, including ham and bacon, 88.12 lbs., and mutton and lamb 8.57 lbs. For purposes of comparison data regarding the estimated per capita consumption of meat in other countries are summarized.

Market prices of live stock (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1905, pp. 286–290*).—Tables are given which show the prices of various classes of live stock at Chicago and Omaha during the year 1905.

The movement of live stock (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1905, pp. 291–293*).—Data regarding the receipts and shipments of live stock and other topics concerning the commercial movement of live stock are summarized.

Registered live stock in the United States December 31, 1905 (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1905, pp. 294–297*).—Statistical data are summarized.

DAIRY FARMING—DAIRYING.

Investigations on the influence of proteids upon milk production and on the relation between starch value and milk yield, A. MORGEN, C. BEGER, and F. WESTHAUSSER (*Landw. Vers. Stat., 66 (1907), No. 1–2, pp. 63–165*).—In experiments with 10 sheep and 1 goat the authors studied the effects of increasing the daily allowance of digestible protein from 3 kg. to 9 kg. in rations containing different amounts of fat.

The results showed that an increase in the amount of protein was followed in most instances by an increase in the yield of milk and milk constituents. The percentages of fat and total solids in the milk, however, were decreased. The increase in the yield of milk due to the feeding of more protein was most marked when the fat content of the ration was 1 kg. per 1,000 kg. live weight. The decrease in the fat content of the milk was more marked when the fat in the ration was low than when it was normal or high. A large amount of fat in the ration increased apparently the yield and fat content of the milk.

Rations having the same starch value exerted the same influence upon milk production only when the amounts of protein and fat necessary for a maximum production were present.

The effect of feeding cows rations rich and poor in proteids, A. SCHMECK (*Illus. Landw. Ztg., 27 (1907), No. 41, pp. 373–375*).—In experiments with 2 cows a comparison was made of rations containing 2.25, 1.58, 1.21, 0.83, and 0.50 kg. of digestible protein per 1,000 kg. live weight. The corresponding nutritive ratios were 1 : 6, 1 : 9, 1 : 12, 1 : 18, and 1 : 30. When less than 1.21 kg. of digestible protein was fed daily there was a decided loss in live weight. The ration richest in protein was the most favorable for milk production.

Influence of feeding beet leaves and tops upon the composition of butter fat, M. SIEGFELD (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 9, pp. 513–524*).—During the feeding of beet leaves and tops to about 40 cows for over 2 months the Reichert-Meissl, Polenske, and saponification numbers were high and the iodin number and the average molecular weight of the nonvolatile fatty acids were low.

Influence of feeding on the composition of butter fat, C. AMBERGER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 13 (1907), No. 10, pp. 614–621*).—In experiments with 2 cows, feeding a ration rich in sugar was without influence on the properties of the butter fat. A ration richer in protein than that ordinarily fed, however, decreased the Reichert-Meissl number from 25.48 to 16.70, the Polenske number from 1.8 to 1.6, and the saponification number from 225.5 to 219.5, and increased the iodin number from 32.1 to 39.2.

The dairy cow, J. S. MOORE (*Mississippi Sta. Bul. 95, pp. 23, figs. 5*).—This bulletin deals in a popular manner with the principal dairy breeds, the selection of cows, the keeping of dairy records, testing milk, dairy feeds, feeding standards, calculating rations, pastures, soiling crops, care of cows, raising calves, and other topics. The difference in individual cows is illustrated by the average records of 2 cows for 3 years. One produced 5,003 lbs. of milk and 294 lbs. of butter at a cost for feed of $34.20 a year, and the other produced 5,725 lbs. of milk and 428 lbs. of butter at a yearly cost for feed of $30.44. A table is given showing the dry matter and digestible nutrients in feeding stuffs. Ten suitable rations for dairy cows are included.

Records of dairy cows: Their value and importance in economic milk production, C. B. LANE (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1905, pp. 111–146, pls. 7, figs. 6; Circ. 103, pp. 38, figs. 10*).—Largely an abstract of Bulletin 75 of the Bureau previously noted (E. S. R., 17, p. 693).

The composition of milk, H. D. RICHMOND (*Analyst, 32 (1907), No. 374, pp. 141–144*).—The average composition of 13,513 samples of milk received from farms and examined during 1906 was as follows: Specific gravity 1.0322, total solids 12.64 per cent, and fat 3.71 per cent. The average fat content of the morning's milk was 3.55 per cent and of the evening's milk 3.88 per cent.

Contribution to the knowledge of milk, E. FYNN (*Centbl. Bakt.* [etc.], *2. Abt., 18 (1907), No. 13–15, pp. 428–439, pls. 2*).—Samples of whole milk and milk diluted to different degrees with water were sterilized by heating at 105° C. on 3 consecutive days. The author observed after 1 week certain microscopic changes in the samples which were attributed to peptonization, and which were more marked the greater the dilution. The samples were studied microscopically in hanging-drop preparations made by diluting a drop of the milk with water and staining by the addition of borax-methylene blue. The many changes observed in the fat globules are described in detail and fully illustrated.

The author also describes the cellular elements observed in both human and cow's milk and the changes taking place in them when mixed with sterile bouillon and kept in the incubator for several days. In sterile bouillon to which a few drops of blood were added similar transformed cellular elements were observed. The observations, however, are insufficient to warrant definite conclusions as to whether or not certain cellular elements in milk are derived from the blood. Sterile milk when added to bouillon seemed to exert a slight bactericidal action toward the typhoid bacilli.

Nature and value of goat's milk, A. BURR (*Milch Ztg., 36 (1907), Nos. 19, pp. 219, 220; 20, pp. 229, 230; 21, pp. 241, 242*).—This is a compilation of information relating to the composition and utilization of goat's milk.

The acid coagulation of milk, C. REVIS and A. PAYNE (*Jour. Hyg.* [*Cambridge*], *7 (1907), No. 2, pp. 216–231*).—Experiments were undertaken to secure information on the increase in acidity of milk in relation to the development of lactic-acid bacteria. The results failed to throw light on the cause of the delay in acid formation in comparison with the increase in bacteria, but are considered by the authors as elucidating some of the chemical changes which take place progressively as milk sours. They suggest, however, as highly probable that the bacteria develop the power of producing acid only after a certain period of growth.

The experiments show that the lactic acid first produced is not neutralized by some of the constituents of the milk. The amount of lactic acid combined with the casein as well as the amount of calcium triphosphate combined with the casein were found to be directly proportional to the total lactic acid present. The authors conclude that the compounds of calcium salts and of lactic acid with casein as they are formed in milk do not possess the definite compositions of the compounds formed by calcium and lactic acid with casein after its separation from milk as described by Söldner and by Van Slyke and Hart.

The presence of a kinase in cow's milk, A. HOUGARDY (*Acad. Roy. Belg., Bul. Cl. Sci., 1906, No. 12, pp. 888–900*).—The digestion of milk by the pancreatic juice is retarded by heating the milk for 20 minutes at 75° C. or above and hastened by the addition of enterokinase. The author found that a cube of coagulated egg albumen was more readily digested by the pancreatic juice when previously macerated in milk. This increased digestibility was, however, nullified by heating the sensitized cube for a half hour at 73°.

The conclusion is therefore drawn that there is present in milk a substance capable of increasing the activity of the pancreatic juice in the same manner as the enterokinase of Pawlow. The name lactokinase is proposed for this hitherto undescribed substance.

Leucocyte standards and the leucocyte content of milks from apparently healthy cows, H. L. RUSSELL and C. HOFFMANN (*Jour. Infect. Diseases, 1907, No. 3, Sup., pp. 63–75*).—The authors have compared the Doane-Buckley and Stokes-Stewart methods of determining leucocytes in milk and have studied the leucocyte content of the milk of the cows of the University of Wisconsin dairy herd from June to October.

Of the two methods compared the Doane-Buckley method is considered more accurate, equally rapid, and less trying on the eyes.

The herd was divided into 2 groups. Group 1 contained 18 cows in perfect health, and group 2 contained 12 cows having udder indurations of varying severity, but with one exception producing apparently normal milk. Of the 537 tests made of the first group, 31.1 per cent fell below 50,000 per cubic centimeter, 19.8 per cent were between 50,000 and 100,000, 39.4 per cent between 100,000 and 500,000, 6.8 per cent between 500,000 and 1,000,000, and 2.9 per cent above 1,000,000. The corresponding percentages for the 371 tests made of the second group were 13.2, 16.4, 45.9, 12.4, and 12.1.

The leucocyte content of the milk of apparently normal animals was often in excess of the standards which have been proposed, indicating, according to the authors, that complete reliance can not be placed upon quantitative standards alone.

The relative importance of streptococci and leucocytes in milk, N. M. HARRIS (*Jour. Infect. Diseases, 1907, No. 3, Sup., pp. 50–62*).—The author concludes that there is at present no reliable method for distinguishing pathogenic from nonpathogenic streptococci in milk, and that the sanitary significance of both streptococci and leucocytes or pus cells in milk has been overrated. He believes that more attention should be given to veterinary inspection of the cow's udder and less dependence placed upon laboratory examination of milk for signs of infectious processes.

The comparative value of bacterial and temperature regulations for a city's milk supply, F. H. SLACK (*Jour. Infect. Diseases, 1907, No. 3, Sup., pp. 76–81*).—Since May, 1904, the regulations of Boston have required that the market milk of that city shall not contain more than 500,000 bacteria per cubic centimeter nor have a temperature above 50° F. The article gives the results of plate counts and temperature determinations of 11,403 samples taken during this period.

The results show that 66 per cent of the samples were within both standards. 11.25 per cent had high temperatures and low bacterial contents, 17.5 per cent had high bacterial contents and low temperatures, and 5.25 per cent were outside both standards.

Of the two tests the bacterial count is considered much the more important.

The bacteriological characteristics of different types of milk fermentations, M. DÜGGELI (*Centbl. Bakt. [etc.], 2. Abt., 18 (1907), Nos. 1–3, pp. 37–49; 7–9, pp. 224–245; 13–15, pp. 439–448, dgm. 1*).—This article gives the bacteriological characteristics of the different groups of lactic-acid bacteria.

Soft-cheese studies in Europe, C. THOM (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1905, pp. 79–109, pls. 3*).—The author visited cheese factories and markets in England, France, Italy, and Germany, paying particular attention to the groups of cheese in which molds are the principal ripening agents.

Mold-ripened cheeses are divided into two groups, the Brie-Camembert group and the Gorgonzola-Roquefort-Stilton group. Rather detailed notes are given on the manufacture of each of these varieties. Of the first group the Brie and Camembert are considered the only varieties worthy of consideration. It is believed that these two types of cheese may be made with success anywhere if the necessary conditions are observed and proper ripening agents introduced.

VETERINARY MEDICINE.

Feeding stuffs and infection, L. PICOLLO (*Bol. Agr. [São Paulo], 8. ser., 1907, No. 1, pp. 20–27*).—The susceptibility of the alimentary tract to infection with anthrax, tuberculosis, and other diseases is briefly discussed with notes on the economic importance of giving attention to the sanitary condition of feeding stuffs.

A new yeast pathogenic to man and animals, F. STEINHAUS (*Centbl. Bakt. [etc.], 1. Abt., Orig., 43 (1906), No. 1, pp. 46–69*).—*Saccharomyces membranogenes* was first obtained from the throat in a case of scarlet fever. Experiments with this organism showed that it was pathogenic for mice, guinea pigs, and rabbits, and that the infection thus produced was severe in all cases. As a rule the eruption of miliary tubercles in all organs appeared in the inoculated animals.

Metabolic products in rabbits inoculated with fatal doses of hog cholera and anthrax bacilli, E. LEVY and L. BECKMANN (*Centbl. Bakt. [etc.], 1. Abt., Orig., 43 (1906), No. 1, pp. 43–48*).—A careful study was made of a normal serum of rabbits as compared with that obtained after inoculating these animals with fatal doses of hog cholera or anthrax bacilli. In these experiments, the conclusion was reached that no toxic metabolic products are formed in the rabbit during the course of these diseases, or at least that no such products pass over into the blood serum.

Rabies as related to rats and mice, C. FERMI (*Centbl. Bakt. [etc.], 1. Abt., Orig., 43 (1907), Nos. 2, pp. 173–178; 3, pp. 218–222*).—In the experiments reported in this paper it was found that nearly all of the inoculated rats and mice developed a fatal form of rabies. In these experiments fixed virus was used. A virus of unusual virulence was obtained and tested on 49 birds belonging to a number of genera. None of these animals became infected.

With regard to the possible distribution of rabies by rats and mice some cases are on record in which the disease was apparently transmitted by the bites of these animals, but the dog is considered to be the main agent. Mice and rats are readily infected by feeding upon rabies virus, a result which is quite contrary to that obtained in experiments with dogs.

The maximum dilution of rabies virus for the production of an infection with this disease, C. FERMI (*Centbl. Bakt. [etc.], 1. Abt., Orig., 43 (1907), No. 5, pp. 446–448*).—By the use of a fixed virus it is found possible to inoculate mice hypodermically using a dilution of 1:50,000. Rats and mice appear to be more susceptible to greatly diluted hypodermic injections than are dogs.

Contagious diseases of animals in foreign countries (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1905, pp. 298–305*).—A statistical summary is given of infectious diseases reported during 1905 in Europe.

The diseases of animals and meat inspection in Western Australia, J. B. CLELAND (*Jour. Dept. Agr. West. Aust., 15 (1907), No. 2, pp. 84–94*).—Particular attention is given to a discussion of infectious diseases which are communicable to man and to other diseases which are of most importance in meat inspection. The pathological conditions referred to by the author include tuberculosis, actinomycosis, hydatids, pleuro-pneumonia, Texas fever, bladder worms, tumors, melanotic conditions, and fatty necrosis.

Tables are given showing the prevalence of the various diseases in animals as determined in the course of meat inspection.

Division of animal industry, V. A. NÖRGAARD (*Rpt. Bd. Comrs. Agr. and Forestry Hawaii, 3 (1906), pp. 165–205, pls. 3*).—A record is given of the correspondence regarding animal quarantine in Hawaii during the year under report.

Some trouble has been experienced in combating glanders in Hawaii on account of the failure of horse owners in the Islands to understand the action and value of mallein. It is believed that glanders prevails to a large extent throughout the Territory.

Brief notes are also given on osteomalacia, osteoporosis, embolic colic in horses and mules, redwater in cattle, sheep scab, epizootic lymphangitis, and various diseases of dogs.

Precipitin reaction as a means of distinguishing between tubercle bacilli of human and bovine origin, A. BONOME (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 43 (1907), No. 4, pp. 391–407*).—The author's experiments and observations on the phenomenon of the precipitation of tubercle bacilli with immune sera showed that the blood sera of animals or man affected with spontaneous cases of tuberculosis have a precipitating power toward proteids from fresh tuberculous tissue or toward proteid substances extracted from cultures of tubercle bacilli. Occasionally normal serum has this power to a limited extent. The precipitating power of the blood serum in a case of tuberculosis does not act in the same manner toward material obtained from different animals which are spontaneously affected with tuberculosis. Thus immune serum of tuberculous human patients was found to be particularly active toward tubercle bacilli and tuberculous material obtained from human beings.

By means of this biological method of precipitation it is possible to distinguish sharply between human and bovine tubercle bacilli.

The action of formaldehyde upon the tubercle bacillus and Staphylococcus pyogenes aureus, G. MARTINOTTI (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 43 (1907), No. 3, pp. 246–257*).—Tubercle bacilli, cultivated in agar and subjected to the action of formaldehyde fumes, show a considerably greater resistance to these fumes than does *Staphylococcus pyogenes aureus*. It was found possible, however, not only to delay the development of tubercle bacilli by means of formaldehyde, but to destroy them entirely.

The effect of toxins upon tuberculous subjects in tuberculous products sterilized by heat, V. GALTIER (*Jour. Méd. Vét. et Zootech., 58 (1907), Mar., pp. 129–132*).—The author considers it as demonstrated beyond question that sterilized tuberculous products are not pathogenic and that the toxin contained in them is not injurious to healthy animals or human beings. Experiments with tuberculous dogs indicate clearly that the toxin contained in sterilized tuberculous meat and other organs exercises no unfavorable effect upon the progress of the tubercular infection.

Modes of tubercular infection in wild animals in captivity, W. R. BLAIR (*Amer. Vet. Rev., 30 (1907), No. 11, pp. 1299–1306, figs. 2*).—The author has had an extensive experience with diseases in captive animals in zoological parks and gives special attention in this article to an account of tuberculosis in such animals. It appears that in most cases of tuberculosis in monkeys and other captive animals, the disease was contracted before the animal reached the zoological park, probably while in the unsanitary quarters of dealers or in unclean cars and transport vessels. The general character of tuberculous lesions found in monkeys agrees closely with those in human beings and the infection usually appears first in the cervical and bronchial lymph nodes.

Tuberculosis in chickens positively identified in New York, S. H. BURNETT (*Amer. Vet. Rev., 30 (1907), No. 11, pp. 1312–1314, figs. 4*).—A short account is given of an outbreak of tuberculosis in a flock of poultry together with notes on the pathological lesions observed. It appears from the study of this outbreak that tuberculosis must be quite generally distributed in poultry, but it was impossible to trace the source of infection.

The influence of mammalian and avian tubercle bacilli on the reaction of the culture medium, O. BANG (*Centbl. Bakt. [etc.], 1. Abt., Orig., 43 (1906), No. 1, pp. 34–43, figs. 2*).—As the result of a long series of cultures with tubercle bacilli of different origin it was found that with regard to its reaction on culture media, the avian tubercle bacillus behaves very much like the bovine form. It appears, however, to render the culture medium somewhat more decidedly alkaline. The reaction produced by the human tubercle bacillus may be somewhat changed by altering the supply of oxygen, but the change thus induced is not great enough to bring about a confusion between the bovine and human tubercle bacillus.

Anthrax and imported animal products, W. HANNA (*Pub. Health [London], 19 (1907), No. 7, pp. 439–459*).—On account of the interest which attaches to the means by which anthrax is spread, particularly through commerce in hair and hides, the author examined into the records of 21 human cases of anthrax in Liverpool.

The study of these cases indicates clearly that all workmen should be warned by proper circulars against the possibility of infection with anthrax, and that all foreign hides from suspected countries should be scheduled under special rules and should be imported only in large canvas-covered bales, requiring mechanical handling. It is recommended that the hides be shipped wet rather than dry and that infected material be traced to its source of origin and an attempt made through official channels to secure veterinary inspection in the locality where the disease originated.

The persistence of the Texas fever organism in the blood of southern cattle, E. C. SCHROEDER and W. E. COTTON (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1905, pp. 71–78*).—Three southern cows were used to test the persistence of the blood parasite of Texas fever. The cows were protected from exposure to the disease during the experiments. It was found that the blood parasite persisted for 10 to 12 years. Apparently excessive infestation with cattle ticks may so reduce the resistance of cattle to Texas fever that an acute form of the disease may develop in cattle which were apparently immune and showed blood parasites in an inactive condition.

Notes on the cattle tick and Texas fever, E. C. SCHROEDER (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1905, pp. 49–70*).—A résumé is given of the life history of the cattle tick. The average time required for a full life cycle is 54 days, and the average length of time for the deposition of the eggs is 7 days. It was determined that adult ticks may be kept without material injury for at least 96 days at temperatures below freezing.

The average incubation period for tick eggs is 25 days, the shortest observed period being 12 days, and the longest 209 days. This time depends largely on the temperature. The eggs may be exposed for several weeks to temperatures below the freezing point without destroying their vitality. On an average, cattle ticks mature in 22 days, the shortest period being 15 days, and the longest 40 days.

Considerable attention was given to a study of the influence of cattle ticks upon cattle aside from being agents in the transmission of Texas fever. In the growth of the cattle tick its weight increases about 10,000 times during the 3 weeks. This constitutes a serious drain upon the vitality of infested cattle, some of which are killed outright. Calves become badly stunted as a result of infestation. Pathological changes were noted in the skin about the point where the ticks were attached. The actual weight of ticks which mature and fall off may amount to ½ oz. to several ounces daily. It was shown that cattle on which from 100 to 150 ticks were daily matured showed in some instances a diminution

in the red blood corpuscles to the extent of 7 or 8 per cent. The exact cause of this destruction of the blood corpuscles was not determined.

A general review is given of the cattle tick as a disseminator of Texas fever. In exterminating cattle ticks it is necessary to consider the maximum and minimum periods required for the tick to pass through its various stages. According to the author's experiments, ticks may live at least 322 days without any host.

An outbreak of rinderpest in the Philippine Islands, R. H. McMullen (*Amer. Vet. Rev., 30 (1906), No. 9, pp. 1063, 1064*).—A description is given of an outbreak of rinderpest on the Island of Luzon which was traced to a shipment of 150 head of cattle from the Island of Mindoro. Infection spread quite rapidly throughout a territory containing 20,000 cattle and carabao, and in some localities the mortality was 90 per cent. The further spread of the disease was completely checked by the preventive inoculation of all exposed animals.

Influence of milk of different degrees of acidity on the health of calves, A. Pirocchi (*Clin. Vet. [Milan], 30 (1907), No. 2, pp. 59-82, fig. 1*).—Careful feeding experiments were carried out on 8 calves, during which milk of a varying degree of acidity was used. In these experiments it was found that milk with a slight acidity, as it comes from cows on a mixed or succulent ration, exercises a more or less laxative effect upon calves. Feeding experiments with milk just on the point of turning sour showed that such milk may be very harmful to calves a week old or less, producing, in some instances, serious gastro-intestinal disturbances.

The action of the ether extract of antitetanus serum, P. Cernovodeanu and V. Henri (*Compt. Rend. Soc. Biol. [Paris], 62 (1907), No. 9, p. 392*).—In experiments in vitro it was found that the ether extract of antitetanus serum possesses striking antihemolytic power in neutralizing the tetanus toxin. Thus, when the ether extract of the serum was diluted a thousand times with a sodium chlorid solution at the rate of 8 parts in 1,000, this solution was capable of completely neutralizing the hemolytic action of 1 cc. of tetanus toxin.

Measurement of anaerobiosis of tetanus bacillus, G. Rosenthal (*Compt. Rend. Soc. Biol. [Paris], 62 (1907), No. 10, pp. 438-440*).—In the author's experience if an aerobic culture of the tetanus bacillus be sown in deep tubes of milk with a pipette, the tubes containing whole milk will show a rapid growth whatever the height of the tubes, while in tubes containing skimmed milk, positive results are obtained after 48 hours to a depth of 9 to 10 cm. In tubes filled with bouillon or peptonized glycerin, an abundant growth of the bacillus was observed after several days to a depth of 15 to 18 cm.

Thrush in horses, F. Lahille (*Bol. Min. Agr. [Buenos Ayres]; 6 (1906), No. 5, pp. 251-261, figs. 9*).—In one locality alfalfa was excessively infested with *Aphis medicaginis*, and since horses fed upon the alfalfa showed symptoms of thrush about the eyes and on the other parts of the skin, it was suspected that the aphis might be the cause of the trouble. An examination of the alfalfa showed that in addition to *A. medicaginis* a number of red spiders were present, particularly *Tetranychus silvestrii*. It is believed that this mite was the cause of the trouble observed in horses.

Hemorrhagic hepatitis in antitoxin horses, P. A. Lewis (*Jour. Med. Research, 15 (1906), No. 3, pp. 449-468, pl. 1*).—The sudden occurrence of a large number of deaths among horses used for the production of diphtheria antitoxin led to the study of the cause of this trouble. It was found not to be due to any alteration in the blood corpuscles, but to the amyloid degeneration of the liver which develops in a certain percentage of cases as the result of frequent bleedings for the purpose of obtaining serum. Horses suffering with amyloid degeneration

of the liver are subject to hemorrhage and rupture of the organ, allowing the blood to flow freely into the body cavity.

The Sarcosporidia of sheep, F. JANIN (*Arch. Par., 11 (1907), No. 2, pp. 233–268, pl. 1, figs. 3*).—An elaborate biological account is given of the peculiar protozoan organisms known as Miescher's sacs and by other names and frequently observed as parasites of domestic animals, including sheep. A study of these organisms has convinced the author that the 2 genera Sarcocystis and Balbiania should be retained and that *B. gigantea*, found about the esophagus of sheep, is identical with *Sarcocystis tenella*. Notes are given on the biology of these parasites and on the various forms observed in their development.

Structure of the spore of Sarcocystis tenella in sheep and goats, L. PERRIER (*Compt. Rend. Soc. Biol. [Paris], 62 (1907), No. 10, pp. 478–480*).—The spore of this micro-organism, belonging to the Sarcosporidia, is described in detail and attention is called to the bearing of these facts upon the relationship between Sarcosporidia and Myxosporidia.

A spirillosis and a hematozoal disease of domestic fowls in the Anglo-Egyptian Soudan, A. BALFOUR (*Brit. Med. Jour., 1907, No. 2413, pp. 744, 745*).—The author observed a spirillosis of fowls apparently identical with a form of septicemia described from outbreaks in Brazil and elsewhere. In the outbreak referred to by the author the birds had been imported from Italy and it is suggested that an infection may have taken place through the agency of ticks on shipboard. The incubation period is believed to be 5 or 6 days.

A piroplasmosis was also observed and the author suggests that this disease may be carried by ticks of the genus Argas.

The biology of the organism of fowl plague, A. LODE (*Centbl. Bakt. [etc.], 1. Abt., Orig., 43 (1907), No. 4, pp. 355–359*).—The literature relating to the pathogenic organism of fowl plague is briefly discussed with notes on the results which the author obtained in his experiments. Pieces of infected tissue placed in glycerin remain infectious for at least 3 to 4 months. The resisting power of the virus of fowl plague in a 50 per cent glycerin suspension was almost equal to that of *Staphylococcus pyogenes aureus*. In general, the resisting power of the virus toward all kinds of antiseptic agencies is greater than that of ordinary bacteria and in the author's opinion raises the question whether *Spirillum parvum* should be considered as belonging to the bacteria.

RURAL ENGINEERING.

Report on irrigation and drainage investigations during 1905–6, W. W. MCLAUGHLIN (*Utah Sta. Bul. 99, pp. 126, pls. 2, figs. 8*).—In the bulletin are included reports upon the various irrigation and drainage investigations carried on by the Utah Station in cooperation with this Office during the years 1905–6.

The irrigation investigations were carried on in Sevier, Tooele, Boxelder, Utah, Millard, Salt Lake, Weber, Morgan, and Cache counties, in each of which attempts were made to determine the proper amounts of water to use in irrigation and the proper number of applications. While various untoward circumstances somewhat impair the reliability of the results, two hypotheses were evolved which further experiments are needed to verify, viz, that "crop production tends to vary as the amount of water applied within certain limits," and "that the productive value of an inch of irrigation water depends upon the amount of water which has already been applied during the season."

The drainage investigations were confined to those portions of the State where land had become boggy or alkaline through seepage of water from adjacent and higher irrigated fields. Experimental drains were installed on various farms in six counties of the State and the results carefully noted in each instance. The

data accumulated have a more particular value to the respective localities than to any others, but the experience so far derived indicates that check gates are necessary at various points in the drains, which may be closed when irrigation water is applied and opened later for drainage. Otherwise soil is washed into the drains, it being evident from the experiments that more care was necessary in the irrigation of under-drained than ordinary fields.

Some suggestions are also made as to needed amendments in the existing drainage law.

Making the most of a small water supply, R. H. FORBES (*Arizona Sta. Bul. 54, pp. 103–111, figs. 2*).—The author describes a system of water distribution especially adapted for orchards and vineyards, in which a pipe leads from the reservoir or pump along the lines of trees or shrubs, a small hole being bored in the pipe opposite each plant.

Some experiments were made upon the flow of water from such small orifices, from which in connection with practical considerations it was decided that the smallest orifices, or those of $\frac{3}{32}$ in. in diameter, gave the best results. The pipe is laid slightly below the surface and each orifice discharges into a shallow basin surrounding the tree or shrub. This basin is mulched over with manure or chip dirt which greatly lessens evaporation. The irrigation plant described by the author consists of a well with water at a depth of 90 ft., a 3 by 14 in. pump cylinder operated by a 12-ft. geared windmill, a 5,000-gal. tank, and distribution lines of $\frac{3}{4}$-in. pipe. This irrigates, even in a region of light winds, 87 useful trees and 32 vines and bushes, besides furnishing the domestic supply for a house, thus showing the possible use which can be made of a very small water supply.

Weirs for irrigating streams, G. E. P. SMITH (*Arizona Sta. Bul. 54, pp. 111–117, fig. 1*).—The author describes the Cipolletti weir, giving the conditions which must be observed in its construction and including a table of discharges for a weir 1 ft. in width.

Determination of stream flow during the frozen season, H. K. BARROWS and R. E. HORTON (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 187, pp. 93, pl. 1, figs. 14*).—In this paper the authors discuss the modifications of the usual methods of stream measurements which are necessary to secure good results when the streams are ice covered. The conditions affecting the formation of ice and its effect on stream flow are considered in some detail particularly with reference to the formation of the ice sheet and the variation in slope due to freezing.

The methods of obtaining winter records of stream flow are described, these consisting usually of readings of gage heights and current-meter discharge measurements. The reading of gage heights is taken to the water surface as shown in a hole chopped in the ice. The discharge measurements are secured by the velocity determinations at holes cut in the ice at points in the cross section. Soundings are referred to the surface of the water in the holes. Velocity measurements are made at 0.2 and 0.8 of the total depth (below the bottom of the ice), the mean velocities at these two points being very nearly in the mean velocity of the vertical.

The results of stream measurements during the frozen season are given for a number of streams in the northeastern United States, the period covering several years. The vertical velocity curves from the results of these measurements show, as is to be expected, a greater drawing back of the curve in its upper portion on account of the retarding effect of the ice than do curves in which the friction effect at the upper surface is merely that of the air.

Progressiveness in Italy, H. C. WEEKS (*Sci. Amer. Sup., 63 (1907), No. 1637, pp. 26233–26235, figs. 3*).—The article describes in some detail the con-

struction of a large drainage canal in Italy known as the Bonifica dell' Agro Mantovano-Reggiano, which drains an area of 80,000 acres south of the Po in the vicinity of Reggio. There are many points of interest in the project, notably in the use of inverted siphons, where the main channel crosses the Secchia River, in the provisions for regulating the drainage in order to retain moisture in the soil when necessary, and in the use of pumps at the outlet for discharging water into the Po at periods of high water.

Public roads: Mileage and expenditures in 1904 (*U. S. Dept. Agr., Office Pub. Roads Circs. 53, pp. 4; 54, pp. 2; 55, pp. 2; 56, pp. 2; 57, pp. 3; 58, pp. 4; 59, pp. 3; 60, pp. 4; 61, pp. 4; 62, pp. 2; 63, pp. 4; 64, pp. 2; 65, pp. 3; 66, pp. 4; 67, pp. 3; 68, pp. 3; 69, pp. 3; 70, pp. 4; 71, pp. 3; 72, pp. 4; 73, pp. 3; 74, pp. 4; 75, pp. 4; 76, pp. 4; 77, pp. 4; 78, pp. 3; 79, pp. 3; 80, pp. 4; 81, pp. 2; 82, pp. 4; 83, pp. 2; 84, pp. 3; 85, pp. 6; 86, pp. 2; 87, pp. 2*).—In this series of circulars information is compiled on the mileage of different classes of roads, the sources of revenue by which they are supported, and the road expenditures in cash and labor by counties in each of the following States: Pennsylvania, Montana, Wyoming, North Dakota, South Dakota, Kentucky, Florida, South Carolina, Nevada, Kansas, Idaho, Colorado, Indiana, Oklahoma, Utah, California, Illinois, New Jersey, Missouri, Louisiana, New York, Ohio, Georgia, Mississippi, West Virginia, Wisconsin, Minnesota, Delaware, Michigan, Rhode Island, Massachusetts, Texas, Connecticut, and Vermont.

RURAL ECONOMICS.

On the proportion and importance of small farms in Sweden, E. SIDENBLADH (*K. Landtbr. Akad. Handl. och Tidskr., 45 (1906), No. 6, pp. 409–438*).—This article treats of the importance of small farms in Swedish agriculture and the various direct and indirect measures adopted by the government for the advancement of small farmers, such as the offering of prizes for well-conducted farms, the payment of traveling expenses for studies in foreign countries or in different parts of Sweden, and the securing of improvement through dairy test associations, educational institutions, etc. It is shown that 46.9 per cent of all farms in Sweden are of less than 5 hectares (12.3 acres) in extent, 22.8 per cent contain from 5 to 10 hectares, and 13 per cent are from 10 to 15 hectares. Only 2.3 per cent of the total number of farms contain more than 50 hectares. About one-fourth (25.9 per cent) of the total arable land is in farms of less than 10 hectares and very nearly one-half in farms of less than 50 hectares.—F. W. WOLL.

Report of the agricultural committee, H. CHAPLIN ET AL. (*London: Tariff Commission, 1906, pp. 555, figs. 19*).—This is the report of a special agricultural committee appointed by the tariff commission of Great Britain "to examine the proposals submitted by Mr. Chamberlain to the country and their bearing upon the agricultural interest."

The committee held 33 meetings, examined 147 witnesses, and received replies to letters of inquiry from 2,103 agriculturists and others concerned in agriculture. The report of the committee is presented under the following topics: Agricultural policy before 1846, agriculture in the nineteenth century, international conditions, recent agricultural conditions in the United Kingdom, imports of agricultural produce and their relation to the home production, experiences of farmers, and conclusions and remedial measures. On the latter point the committee says:

"We are of opinion that, for removing the disabilities under which British agriculturists suffer, a change in the fiscal policy of the country is absolutely necessary, but if this change is to be permanently effective it must be combined

with measures dealing with transport, the enlargement of the powers of the board of agriculture, and local taxation. We are also of opinion that the position of the industry generally would be improved if means could be found to create further facilities for land purchase in the United Kingdom."

An appendix contains the evidence of witnesses, the replies to letters of inquiry, and memoranda on the possibilities of sugar manufacture in the United Kingdom, sugar beet and tobacco cultivation in the United Kingdom, and the purchase of land bill for England and Wales.

Share system in cane cultivation in Fiji, Hawaii, and Mauritius, H. M. JACKSON (*West Indian Bul., 6 (1905), No. 1, pp. 18–21; 7 (1906), No. 4, pp. 311–316*).—The share system consists in the division of the land to be cultivated into blocks of about 60 acres, the owners doing the preliminary work of preparing the land and planting it before handing it over to the cooperative company of laborers who do the balance of the work until the cane is fit for cutting. The owners also advance to the workers one shilling a day each for maintenance with which they are duly debited. The cane is sold to the factories, and the proceeds, after deducting the landowner's share and all expenses of cultivating, harvesting, carting, etc., are divided pro rata among the laborers.

The advantages of the system are a lessening of the annual heavy expense of introducing a new supply of laborers, more efficient service on the part of the field hands, higher wages for service, and the retention of the farm help on the land. This latter effect is regarded as affording a solution of the farm-help problem in these countries.

Report of the commission on contract labor, P. FAVRE (*Bul. Soc. Vaud. Agr. et Vit., 1907, No. 203, pp. 407–414*).—This is a report presented to the assembly of delegates of the agricultural and viticultural society of the Canton of Vaud at Lausanne in December, 1905.

The questions sought to be answered were: Why contracts between farmers and hired help were not respected by the latter, and what remedy could be suggested? As answer to the first question the committee names two causes. The great scarcity of farm help is assigned as the chief cause, the laborer knowing that if he leaves one employer he can readily find another place at possibly an increase of wages. The causes assigned for the scarcity of reliable farm laborers are the system of education in Vaud, insufficient remuneration for farm labor, too many hours for a day's labor—14 to 16 daily and little less on Sundays—and the various social industries which offer steady employment and other advantages which draw men from the farm to the towns and the cities. The absence of a law controlling the relations between master and hired man is given as the second cause why contracts are not better respected by hired farm laborers.

As a remedy the commission recommends the passage of a suitable national law which should aim to safeguard the rights of the master in matters pertaining to the hiring of laborers.

Statistics of agricultural associations for 1905 (*Bul. Agr. [Brussels], 23 (1907), No. 3, pp. 215–280*).—Detailed statistics of agricultural organizations in Belgium for 1905 in comparison with preceding years are reported.

The statistics relate primarily to the number of societies in each province, the membership, and the business transacted, and include the following general groups: Federations of professional agriculturists; cooperative societies for the purchase of seeds, commercial fertilizers and feeding stuffs, and farm machinery; cooperative societies for the manufacture and sale of dairy products; agricultural credit organizations, and agricultural insurance societies, which include the insurance of live stock and crops destroyed by hail.

The agricultural population and the farm-help problem in England, B. SKALWEIT (*Mitt. Deut. Landw. Gesell., 22 (1907), Beilage No. 6, pp. 27-34*).—Statistical data are presented regarding the number of the rural population and different groups of farmers and farm laborers in the United Kingdom for the years 1851 to 1901, with a discussion of the effect of recent legislation and the price of wheat on the English agricultural labor problem.

The statistics show that while the population in the United Kingdom increased about 10 millions from 1870 to 1900 the rural population decreased about 4 millions, and that farmers and farm laborers, including males and females, decreased from 3,454,000 in 1851 to 2,262,000 in 1901. The tendency of recent legislation has been to increase rural settlement. A number of bibliographical references are included.

Cooperation in agriculture [in Denmark] (*Danmarks Statis. Meddel., 4. ser., 22 (1907), pt. 5, pp. 69*).—Statistical data with a discussion regarding the development of agricultural cooperation in Denmark along the lines of dairying, registration of most productive cows, slaughterhouses, and exportation of eggs.

The data show the number of cooperative dairies in 1906 to have been 1,068, with a membership of about 157,500. Registry societies, which record food consumption as well as milk production as the basis of determining the most productive cows, numbered 415 in 1905, with a membership in 1903 of 8,504, controlling 148,000 cows. There were 32 cooperative slaughterhouses in 1905 with 70,000 participants and 790 cooperative egg unions in 1906 with 57,000 members.

An agricultural credit system for Cape Colony (*Agr. Jour. Cape Good Hope, 30 (1907), No. 2, pp. 186-192*).—This is a review of a pamphlet issued by the treasury department in regard to proposed legislation for improving the credit of agriculturists in the colony.

The pamphlet reviews the conditions of agriculture, the lack of capital, the burden of high interest, and the importance of encouraging the development of agriculture in Cape Colony. The proposal is made to adopt a system of government credit and superivision largely conformable to the Australian and New Zealand system (E. S. R., 18, p. 687), with slight modifications as to amounts and classes of loans, payment of costs, length of period during which loans may run, and on management and control of the funds.

The granger movement in Illinois, A. E. PAINE (*Univ. Ill. Bul., 2 (1904), No. 2, pp. 53*).—The author briefly reviews the origin, aims, and history of the organization known as the Patrons of Husbandry among farmers in the United States, with a detailed account of its progress in Illinois.

The greatest activity was manifested in 1873 and 1874, during which 1,465 granges were organized. This was followed by a decline for a number of years. Since 1880, however, "there has been a revival, and the grange, with a gradually increasing membership, has been able to pursue a well-defined policy, emphasizing the need of education and the necessity for self-improvement. . . . There need be no hesitation in affirming that no small share of the political, social, and industrial progress of the farmer in Illinois may be traced to the grange." An extensive bibliography is included.

Crop Reporter (*U. S. Dept. Agr., Bur. Statis. Crop Reporter, 9 (1907), No. 6, pp. 41-48*).—Statistics and notes on the condition of crops, and the supplies, value, and prices of agricultural products in the United States and foreign countries are summarized. A special article gives statistics showing the increase in rubber production in recent years and the acreage under cultivation in various countries to meet the increased demand for this product.

Returns of produce of crops in Great Britain with summaries for the United Kingdom, R. H. REW (*Bd. Agr. and Fisheries [London], Agr. Statis., 1906, pt. 2, pp. 89-168*).—The estimated total produce, acreage, and estimated

yield per acre for 1906 in comparison with preceding years are reported. A summary of weather statistics of Great Britain is included.

The gross production of the principal crops in the United Kingdom are given as follows: Wheat 7,577,000, barley 8,435,000, and oats 21,859,000 quarters, respectively; potatoes 6,089,000, turnips 27,583,000, mangels 9,881,000, and hay of all kinds 13,512,000 tons, respectively.

Illinois Crop Report for December 1, 1906, W. C. GARRARD (*Statis. Rpt. Ill. Bd. Agr., 1906, Dec. 1, pp. 94*).—A summary of the reports of correspondents as to the yield, value, and price of the principal farm products and the number and value of live stock of Illinois for the year 1906, in comparison with similar data for preceding years. Corn was the leading crop, being valued at $103,489,520, followed by oats valued at $27,462,112. The total value of the principal crops and live stock in Illinois for 1906 was $253,409,404.

Kansas statistics, 1905–6, F. D. COBURN (*Quart. Rpt. Kans. Bd. Agr., 25 (1906), No. 100, pp. 73; Bien. Rpt. Kans. Bd. Agr., 15 (1905–6), pp. 997–1263*).—In these reports tables are given showing the State's population by counties and cities, assessed valuation, acres, yields, and value of agricultural products, and numbers and value of live stock for the years 1905 and 1906. The total acreage of the State is 52,572,160, of which 31,562,268 acres were under culture in 1905 and 30,989,263 in 1906, the values of all farm products, including animals slaughtered, being $238,836,425 and $246,905,051, respectively. The live stock numbered 6,686,520 in 1905, having a value of $169,821,157, the corresponding figures for 1906 being 6,419,742 and $177,429,816. Corn and wheat were the leading products of the State.

Official report on the condition of crops and wages of farm hands (*Ohio Dept. Agr., 1907, pp. 13*).—The condition of crops in Ohio on April 1, 1907, compared favorably with that at the same time last year. Live stock wintered well and were in fine condition. The average wages of farm hands were $21 per month with board, $29 without board, $1.10 per day with board, and $1.40 without board.

"The labor problem is still a serious one for farmers, and although wages have materially advanced over last year, farmers are unable to secure sufficient help to properly carry on farming operations. In those localities situated in close proximity to cities it is almost impossible to secure reliable farm help."

Prices of agricultural and other products in Servia (*Statistique des Prix des Produits Agricoles et Autres dans la Royaume de Serbie. Belgrade: Govt., 1906, pp. LVII+429, dgms. 4*).—Detailed statistics of the prices of agricultural products for each month of the years 1901 to 1905, inclusive, are reported.

Danish agriculture in 1906, H. HERTEL (*Tidsskr. Landökonom., 1907, No. 1, pp. 1–40*).—A general review of agricultural conditions during the year.

Imports of agricultural produce in 1906 (*Jour. Bd. Agr. [London], 13 (1907), No. 10, pp. 615–621*).—Statistics relating to the source, quantity, and value of agricultural products imported into the United Kingdom in 1905 and 1906 are reported and discussed. The total value of all farm imports in 1906, the bulk of which were food supplies, amounted to £246,940,000. The general tendency of prices for all imported farm products was higher in 1906 than in the preceding year. Argentina again surpassed the United States in the quantity of refrigerated meat supplied to Great Britain, but the price of American meat was more than 50 per cent higher than the Argentine product.

[Agricultural statistics of Uruguay for 1905–6], A. ARECHAVALETA (*Montevideo: Govt., 1906, pp. 32*).—This report gives statistics and discusses the number of hectares under cultivation and yields of wheat, corn, flax, oats, barley, and canary seed; the number of farm laborers; the number of farms in operation by native and foreign owners or renters, and the number of work animals and

implements, with detailed information regarding the 449 threshing machines owned in Uruguay. There were 22,593 farmers in 1906, of which 10,807 owned and 11,786 rented the farms worked; 13,219 were natives and 9,374 foreigners.

Season and crop report of the Bombay Presidency [and Sind] for the year 1905–6, P. J. Mead (*Season and Crop Rpt. Bombay, 1905–6, pp. VI+68*).—In addition to statistics on rainfall this report discusses the agricultural conditions of the presidency and the district of Sind for the year 1905–6.

The total area under crops and in fallow was 39,097,000 acres, of which 20,730,000 acres were in food crops and 5,911,000 acres in nonfood crops. The live stock numbered 13,849,000, and the cotton production was 1,232,000 bales. On account of deficiency in rainfall crops were below the normal and prices were generally high. Detailed statistical data are also presented on the number of acres in cereals and pulse, irrigation, sources of water supply, and the number of acres of uncultivated land.

AGRICULTURAL EDUCATION.

Statistics of agricultural institutions in Prussia for 1903–1905 (*Landw. Jahrb., 35 (1906), Sup. 5, pp. XXII+485*).—This report contains detailed statements concerning the organization, faculty, income, courses of study, attendance, etc., of the agricultural institutions of different grades in Prussia. These include (1) agricultural, forestry, and veterinary schools known as academies, (2) secondary agricultural schools (Mittelschulen), (3) elementary agricultural schools (niedere Schulen), (4) special schools, such as schools of pomology, horticulture, fruit growing, meadow culture, dairying, etc., (5) special courses for adults, and (6) normal schools for the training of teachers of agriculture. A tabular review is also given of the progress and present status of rural continuation schools. Twenty appendixes contain rules and decrees concerning the qualifications of teachers, examinations, the inspection service, and other matters relating to the institutions listed in the report.

Agricultural education in England and Wales (*Jour. Bd. Agr. [London], 13 (1907), No. 11, pp. 641–660, map 1*).—This is a very satisfactory brief summary of the educational institutions of different grades in England and Wales which afford instruction in agriculture. An outline of the different lines of instruction is first given, including courses for degrees in agriculture, diploma courses, short courses, and the special instruction in dairying, horticulture, poultry keeping, and forestry. Then follows a description of the different institutions engaged in this work, the courses offered by each, the tuition fees and other expenses, their land, buildings, and other equipment, and in some cases other details.

Normal training in high schools (*Advance pages from the Bien. Rpt. State Supt. [Pub. Instr.] Nebr. [1907], pp. 99–102*).—This embodies an account of the steps taken to inaugurate normal training courses in the high schools of Nebraska after September 1, 1907, in accordance with the law enacted by the State legislature in 1905.

A committee of the State Association of Superintendents and Principals of Accredited High Schools, appointed to formulate general requirements for normal training courses in high schools, decided that a high school, in order to be approved for a normal training course, must be accredited by the University of Nebraska, must have at least 3 teachers, normal training credits to be open only to high school graduates, the course to include a review in the common branches for at least 9 weeks not earlier than the eleventh grade, a study of American history for at least 1 semester in the eleventh or twelfth grade, and at least 72 periods of professional training in the twelfth grade. Schools offering this

course must have a reference library on professional subjects and must teach elementary agriculture. Outlines are given to show the plan and scope of the work in the common branches and the professional training, including agriculture.

The work in agriculture is intended to cover 2 semesters or 1 year. The work of the first semester includes farm animals, class work 32 periods and laboratory work 8 double periods; milk and its products, 20 periods and 5 periods, respectively; and soils, 12 periods and 3 periods, respectively. In the second semester 12 class periods and 8 double laboratory periods are devoted to soils, 18 class periods and 12 double laboratory periods to field crops, and 18 class periods and 12 double laboratory periods to orchard and garden crops. The subjects for the different laboratory exercises are given, and also lists of equipment needed for laboratory work and of reference books for the library.

For schools not equipped to carry the 2-semester course a briefer 1-semester course is outlined.

Outlines in agriculture for Nebraska State junior normal schools (*Lincoln: Dept. Pub. Instr., 1906, pp. 55, figs. 5*).—These are outlines prepared by the instructors in agriculture in the Nebraska State junior normal schools under the direction of the University of Nebraska. They include detailed suggestions for the study of field crops (cereals and forage crops), soils, and horticulture. Nineteen experiments in soils are described. Under the subject of horticulture the following topics are treated: Selection of site for gardens and orchards, propagation, transplanting, pruning and training, treatment of insects and diseases, school grounds, tillage of gardens and orchards, and the school garden. There is also a syllabus for the study of farm animals.

The home economics movement, I, ISABEL BEVIER and SUSANNAH USHER (*Boston: Whitcomb & Barrows, 1906, pp. 67*).—This is a brief historical account of the development of education for women in the United States, the origin of instruction in home economics in agricultural colleges and State universities, the development of special cooking schools, and the origin and development of home economics in public schools.

Agriculture in public schools, W. C. LATTA (*Nature-Study Rev., 3 (1907), No. 2, pp. 43–49*).—This is a discussion of what should be included in the course in agriculture for public schools, why agriculture should be taught in public schools, and how it should be introduced. Among the things to be included are the phenomena and forces of nature, considering first the most familiar and later those less known, the relations of cause and effect, the effect of environment on the life of the child, on all life, and on the practice and products of the farm, and the story of nature as a whole so far as it comes within the scope of the child's mind and affects him.

Nature studies on the farm. Soils and plants, C. A. KEFFER (*New York, Cincinnati, and Chicago: American Book Co., 1907, pp. 154, figs. 59*).—This is a series of reading lessons for children dealing in a simple and popular way with soils and their relation to plant life, the relation of the forest to the soil, weeds, "the plant's business," buds and seeds, sowing the seed, rotations, cultivation, the hoed crops, cereals and grasses, hotbeds, cuttings, transplanting, the garden, the orchard, and other subjects of the country home. The last few pages of the book are devoted to suggestions to teachers, including some information concerning each lesson, and suggestions for exercises to be conducted in connection with the readings.

Practical suggestions for improving and beautifying rural school grounds, T. H. SCHEFFER (*Industrialist, 33 (1907), No. 15, pp. 227–235, dgm. 1*).—This article gives specific suggestions concerning many matters related to the planning, planting, and using of grounds surrounding rural schools. The topics considered are the selection of a site, size of grounds, the plan and location of

buildings, the walks and driveways, fences, grading, playgrounds, and lawn, the location of trees and shrubs, the kinds of trees and shrubs to plant, how to plant them, the care of trees, the use of flowers, and the district policy with reference to the manner of getting the work done.

Arbor Day (*U. S. Dept. Agr., Forest Serv. Circ. 96, pp. 4*).—This circular comprises brief suggestions concerning the lesson of the day, nature study and forestry, forest topics to group about Arbor Day, and planting.

MISCELLANEOUS.

Seventeenth Annual Report of Arizona Station, 1906 (*Arizona Sta. Rpt. 1906, pp. 127–166*).—This consists of an administrative report on the work of the station as a whole and four departmental reports. These reports contain, among other things, notes on the culture of date palms, olives, cassava, taniers, taros, avocados, and tobacco; the results of feeding experiments with sheep; notes on alfalfa root rot, and a financial statement for the fiscal year ended June 30, 1906.

Nineteenth Annual Report of Rhode Island Station, 1906 (*Rhode Island Sta. Rpt. 1906, pp. 149–341+VII*).—This contains the organization list of the station, a report of the director reviewing briefly the work of the station during the year, departmental reports abstracted elsewhere, a financial statement for the fiscal year ended June 30, 1906, exchanges, etc.

Circulars, finances, meteorology, index (*Maine Sta. Bul. 137, pp. 283–314+VIII*).—This bulletin consists of reprints of press bulletins issued during the year, meteorological observations noted elsewhere, a financial statement for the fiscal year ended June 30, 1906, an index to Bulletins 125–137 which collectively make up the twenty-second annual report of the station, and notes on the work and history of the station. The subjects of the newspaper bulletins and circulars are as follows: Potato scab; white grubs and June beetles; red-humped caterpillar; the yellow-edge or mourning-cloak butterfly; elm leaf-curl; yellow-necked caterpillar; the cecropia moth; tent caterpillar; and tussock moths.

Twenty-second Annual Report of the Bureau of Animal Industry, 1905 (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1905, pp. 364*).—This includes a report of the chief of the Bureau for the fiscal year ended June 30, 1905, numerous articles abstracted elsewhere in this issue, a list of the publications of the Bureau during 1905, and the rules and regulations of the Bureau issued in 1905.

Publications of the Bureau of Animal Industry (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 106, pp. 24*).—A complete list of the publications of this Bureau to April 1, 1907.

NOTES.

Alaska Stations.—A breeding station has recently been established at Kodiak as a fourth substation. Experiments in cattle raising are to receive special attention, but hardy breeds of sheep and possibly Shetland ponies may be added. Work has been inaugurated with a herd of Galloways, this breed being selected because of its hardiness, its ability to "rustle," and its heavy coat, all of which qualities adapt it to Alaska conditions. In its initial stage the chief object will be to ascertain whether cattle can be bred successfully in Alaska, and if so how they should be managed, how best to produce the necessary feed, and related questions. A secondary purpose is to produce a general-purpose cow from the Galloway, since dairy products are needed in Alaska as well as beef, and none of the distinctive dairy breeds are adapted to the climate. It is planned to offer the surplus stock for sale to settlers.

Florida University and Station.—E. L. Wartman, of Citra, Fla., has been appointed on the board of control, vice A. L. Brown, whose commission expired. The last legislature, which adjourned June 1, appropriated $570,711 for higher education during the next biennium. The State board of education, which has general supervision and allotment of this fund, has decided to allot $150,000 to the university for buildings, $40,000 of which is to be used for the construction of laboratories and offices for the station. For the ensuing biennium $10,000 has been set aside for farmers' institutes and $5,000 for farm buildings and improvements on the station grounds. John Belling has been elected assistant in horticulture.

Kentucky College and Station.—B. R. Hart, assistant chemist in charge of feed analysis in the station, and W. G. Campbell, formerly of the station, have accepted positions with the Bureau of Chemistry of this Department, in connection with the food inspection work. H. D. Spears, assistant in chemistry in the college, has been placed in charge of the feed work of the station.

Maine Station.—Frank M. Surface, Ph. D., a recent graduate of the University of Pennsylvania, has been appointed associate biologist in the station, and will be engaged in collaboration with Doctor Pearl in investigations in plant and animal breeding. After taking his degree Doctor Surface was elected to a Harrison research fellowship in zoology at the University of Pennsylvania, which he resigned to accept the position at the station.

Michigan Station.—F. A. Spragg, a graduate of the Montana College, has been appointed assistant agronomist, and will have charge of the breeding work with cereals, legumes, and farm crops. A new insectary is to be constructed at once as an annex to the agricultural laboratory. Plans have been submitted for a new agricultural building to cost $150,000.

Nebraska University and Station.—According to a note in *Science*, F. G. Miller, in charge of forestry work, has resigned to accept a similar position in the newly established forestry school of the University of Washington. He will be succeeded by F. J. Phillips of the Forest Service of this Department.

New Hampshire Station.—Jasper F. Eastman, a recent graduate of the Massachusetts College, has been appointed assistant in agriculture. T. J. Headlee, assistant entomologist, has resigned to become entomologist at the Kansas College and station.

Cornell University and Station.—B. M. Duggar, of the University of Missouri, has been elected to the professorship of plant physiology in its relations with agriculture. It is expected that he will assume his duties next February. J. B. Norton, formerly of this Department, has become assistant in the department of plant biology. The new appropriation for the college of agriculture carries $150,000 for maintenance, $50,000 for equipment, and $25,000 for building barns, a total of $225,000 for the year.

North Dakota College.—A summer school of traction engineering was held at the college July 2 to 26 under Prof. P. S. Rose, of the engineering department. The forenoon of each day was devoted to lectures on traction engineering and the economics of thrashing. In the afternoon there were lectures on gas engineering and classes in arithmetic. The practical work consisted in running both steam and gasoline traction engines, setting valves, putting in boiler tubes, babbitting boxes, lacing belts, etc., all under the direct supervision of experts in those lines of work. Each student was given time enough at practice work to become thoroughly proficient in handling and adjusting traction engines. Considerable attention was also given to the handling of grain separators.

Ohio Station.—H. S. Woods has been appointed assistant in animal nutrition. C. H. Kyle, assistant agronomist, has resigned to accept a position in the Bureau of Plant Industry, and F. A. Welton, assistant chemist, has been transferred to his position. Gail T. Abbott has been appointed second assistant in agronomy. J. S. Houser, assistant entomologist, has resigned to become entomologist of the Cuban Experiment Station.

Oregon College and Station.—At the last meeting of the board, professorships were established in agronomy, poultry husbandry, animal husbandry, and veterinary science. Dr. James Withycombe will have charge of the work in the last two lines.

Pennsylvania College and Station.—Thomas F. Hunt, dean and director, and Alva Agee, professor of agricultural extension, assumed their duties July 1. Dr. H. P. Armsby remains with the college as director of the institute of animal nutrition. The department of agriculture has been divided into departments of agronomy and animal husbandry. J. W. Gilmore, assistant professor of agronomy at Cornell University, has been elected professor of agronomy; and J. H. Barron assistant in experimental agronomy. Bailey E. Brown, of the Bureau of Soils, has, as previously noted, been assigned to the experiment station under the title of assistant professor of agronomy, and with the assistance of J. J. Skinner, also of the Bureau of Soils, is engaged in the study of the fertilizer plats which have been under experiment during the past twenty-five years. Provision has also been made for an instructor in agronomy, with special reference to soils. T. I. Mairs has been placed in charge of the department of animal husbandry and provision made for an assistant in animal husbandry and an instructor in poultry husbandry. C. L. Gooodling, a graduate of the college, has been elected assistant in animal husbandry, and an assistant professor of dairy husbandry, with special reference to the manufacture of cheese, will be appointed. J. P. Stewart, as previously noted, has been elected assistant professor of experimental horticulture and has begun investigations in that subject. The position of assistant professor of botany with special reference to plant pathology, including both college and station work, has been established. The chair of agricultural chemistry has been divided. Dr. William Frear will continue as vice-director of the station and professor of experimental agricultural chemistry, and M. S. McDowell has been promoted to be assistant professor of experimental chemistry.

The legislature passed a deficiency bill for the college amounting to $179,-530.92, which included $85,000 for the completion of the new agricultural building. The contract for finishing the new building has been let. The total appropriations for the agricultural and dairy buildings, including the heating tunnel, have been $284,169.60. The general appropriation bill for the college carried $274,000. A special item of $70,000 was included in the bill for the school of agriculture and $4,000 for experiments on tobacco by the station.

Rhode Island Station.—E. A. Mallette, who has been in the employ of the horticultuural department for a few months, has been appointed a member of the station staff.

South Dakota Station.—A department of dairy industry has been added to the station. W. A. Wheeler, for the past two years botanist and entomologist in the station, has resigned, and is succeeded by Edgar W. Olive, Ph. D., of the University of Wisconsin. Doctor Olive will have charge of the botanical work and an assistant will be provided to take charge of the entomological work.

West Virginia University.—T. C. Johnson, instructor in horticulture and botany in the college of agriculture, has been made assistant professor of these subjects, and D. W. Working, of Denver, Colo., and formerly on the editorial staff of *American Grange Bulletin*, has been appointed superintendent of agricultural extension teaching. The establishment of a department of highway construction in the college of agriculture has been authorized.

Macdonald Agricultural College.—A provisional announcement of this institution, which is to open this fall, has been issued by the principal, Dr. J. W. Robertson. Three departments have been organized—a school for teachers, a school of agriculture, and a school of household science. The requirements for admission to the school for teachers are similar to those which have been in force at the McGill Normal School. Other teachers will be admitted under certain regulations for courses in nature study, school gardening, household science, and manual training. Candidates for admission to the school of agriculture must have worked for a season on a Canadian farm. No entrance examination is required of short-course students, but all candidates for the one and two year courses in agriculture and household science will be required to pass an examination in the elementary branches.

Secondary Education in Canada.—The experiment of introducing agriculture into some of the high schools of Canada is about to be tried. It is proposed to make a grant to each high school that will establish a class in agriculture and agree to appoint a teacher recommended by the department of agriculture. A plat of ground for demonstration or experimental purposes must be provided, the classes specializing according to the agricultural needs and conditions of the districts in which the schools are located. The teachers' time is to be devoted exclusively to agricultural work, but any time not required by their respective schools is to be available for assisting and encouraging agriculture and nature study in rural schools and in sending the department of agriculture information regarding pests, new and interesting developments in connection with farming, etc.

Agricultural and Industrial School for Korea.—J. Arthur Thompson, a graduate of the College of Agriculture of the University of Illinois, is on his way to Korea to assist in the establishment of an agricultural and industrial school. He is being sent by the Methodist Conference, and spent a year at Hampton Normal and Agricultural Institute preparing for the work. The people of Korea have raised $1,000 to establish the school, and the land has been purchased. On his arrival at Songdo, Korea, Mr. Thompson will begin his new

work at once, assisted by Mr. T. H. Yun, a native Korean educated in the United States.

Avondale Forestry Station.—The Journal of the Department of Agriculture and Technical Instruction for Ireland gives an account of the establishment, object, and work of the Avondale Forestry Station and Forestry School. The station grounds comprise about 550 acres, including about 100 forest plats of an acre each for the study of trees grown under sylvicultural methods in distinction from arboricultural conditions, a pinetum containing about 100 species, and an arboretum with about 150 species of 40 genera. The forestry school associated with the station was opened in the autumn of 1904 for the purpose of training working foresters and woodmen. A syllabus is given of the lectures for its four-years' course.

A New Cereal Culture Station in Italy.—By an act of June 20 there was established at Rieti an experiment station for the culture of cereals, with the object of improving and increasing the production of wheat and other cereals by means of laboratory and field experiments.

Investigation of Spike Disease.—According to *Indian Forester*, the Maharaja of Mysore has announced a reward of 10,000 rupees to anyone who will discover the cause of spike disease among sandal trees and suggest a thorough and effective and, at the same time, a cheap and easily applicable remedy for its eradication. The offer will remain open for three years. Each applicant must forward a report of his investigations, accompanied by microscopic slides, to the secretary of the general and revenue departments, Mysore. The conditions are that the cause of the disease must be definitely and clearly determined, and an effective and cheap remedy prescribed, such as would perceptibly check the spread of the disease within a year. Persons desirous of investigating this subject may obtain from the conservator of forests in Mysore copies of a printed compilation of the more important papers bearing on the subject of the eradication of this disease.

Miscellaneous.—The Agricultural and Mechanical College for the Colored Race, at Greensboro, N. C., has added a dairy department and a teachers' training department to prepare teachers especially for instruction in agricultural and mechanical branches. The college session has been increased by one month and a preparatory course is to be offered.

The Horticultural College, Swanley, England, has arranged a one-year course in natural history for students who have passed through the ordinary training in gardening and desire additional training in natural-history subjects in order to qualify as teachers of gardening and nature study. The work will be practical, the first two terms of the course to be devoted to general work in botany, zoology, and geology, and the third term to special subjects.

It is announced that the next meeting of the American Association of Farmers' Institute Workers will be held at Washington, October 23 to 25.

E. D. Merrill, botanist of the bureau of science in the Philippine Islands and a former employee of this Department, who has been in the islands for the past five years, has returned to this country on leave.

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U. S. DEPARTMENT OF AGRICULTURE

OFFICE OF EXPERIMENT STATIONS

A. C. TRUE, DIRECTOR

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U. S. DEPARTMENT OF AGRICULTURE.

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- Tuskegee Station: *Tuskegee;* G. W. Carver.[a]

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[a] Director. [b] Assistant director. [c] Special agent in charge. [d] Acting director.

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